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THE
DEFORMITIES OF THE
FINGERS AND TOES

ANDERSON

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THE DEFORMITIES OF THE FINGERS AND TOES

BY

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PREFACE

THE following pages are developed from a course of Hunterian Lectures delivered by the Author in the theatre of the Royal College of Surgeons, in 1891. The matter has been revised and brought up to date, and augmented by a section upon the congenital deformities of the hands and feet.

WILLIAM ANDERSON.

2 HARLEY STREET, W.

March 1897.

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THE DEFORMITIES OF THE FINGERS AND TOES

THE section of surgical disease treated in the following pages is unambitious in its scope, but it is, nevertheless, one that deserves the attention of every surgeon and pathologist, because it comprises a group of ailments which are the source of much pain and crippling, and because it offers many problems of causation that are still unsolved. It is true that none of these affections threaten life, but in medicine, as in law, it is often the value of the principle involved rather than the magnitude of the interests immediately at stake that invests the case with importance.

There is a material advantage to be gained by studying the deformities of the hands together with those of the feet, for it will be found that nearly all the forms of contraction that appear in the one are represented in the other, and a comparison of the conditions under which the two sets of affections arise may throw light upon the pathogeny of both. At the same time, if we glance at the structural and functional differences

in the hand and foot, and at the fact that civilised life imposes artificial restraints upon the freedom of action of the one, while it cultivates to a marvellous degree of perfection the variety and precision of movement in the other, we shall understand that although certain deformities of the fingers may have a strict pathological analogy with those of the toes, the effects produced, and the treatment required may differ essentially in the two sets of cases.

It will be seen that our knowledge of some of the affections to be described is of very recent date, and that certain diseases, frequent in occurrence, obvious in character, and very inconvenient or painful in results, have only found a place in our text-books within recent years. Even the most ancient in point of literary existence scarcely dates beyond the third decade of the present century; while the youngest, when regarded in the same aspect, is merely a child of a few winters; and yet both the one and the other may be nearly as old as mankind.

SECTION I

CONTRACTIONS OF THE FINGERS

THESE may be grouped as follows: 1. Contractions due to pathological processes taking place in the cutaneous and fascial structures of the palm and palmar surface of the fingers. This includes the so-called "contraction of the palmar fascia," with which the name of the great surgeon Dupuytren is inseparably connected, as well as another affection of similar character, but different pathological origin. 2. Contractions due to developmental irregularities in the bony and ligamentous elements of the articulations. Under this heading come the deformity which may be termed "hammer finger" and the closely allied lateral distortions of the digits—affections which are chiefly of importance in their bearing upon analogous conditions of the toes. 3. Contractions arising from shortening of the finger flexors, without paralytic or spastic complications. 4. Contractions due to unbalanced action of the flexor muscles after accidental solution of continuity of the extensor tendons. 5. Contractions arising from nutritive changes in

the motor apparatus consequent upon long immobilisation of the part, with pressure ; or from inflammatory processes in the inter-muscular planes, or in the muscles themselves. 6. Contractions dependent upon inflammatory articular disease of traumatic or constitutional origin. 7. Contractions of neuropathic origin, paralytic or spastic. Under this denomination, as under the last, only those questions which concern the surgeon will be taken into consideration. 8. Trigger finger ; a condition not yet susceptible of scientific classification. 9. Congenital deformities not included under any of the preceding headings.

CONTRACTIONS INVOLVING THE DIGITAL AND PALMAR FASCIÆ.

The clinical features of the disease called Dupuytren's "contraction of the palmar fascia" were well known before the true seat of the morbid process was surmised ; but the Greek and Arab writers, and their European followers down to the end of the last century, make no reference to it. The first accessible descriptions are those of Sir Astley Cooper in his "Treatise on Fractures and Dislocations" published in 1822, and of Boyer in the eleventh and last volume of his "Maladies Chirurgicales," issued in 1826. The latter is really a very correct account from the clinical aspect ; and although the author could suggest no

better pathological explanation than that implied by the name “*crispatura tendinum*,” which he found already given to the disease by previous writers, in works that cannot now be traced, he accepts it with commendable hesitation.¹ Sir Astley Cooper, on the other hand, supplies a less detailed description, but recognises the non-tendinous origin of the disease. The classical essay, however, was that of Dupuytren (1831), which, partly from its intrinsic merits and partly from the fame of the writer, attracted wide attention, and called forth within the next few years a number of eminently scientific observations upon the pathology of the complaint. More recently the affection has received close attention from many distinguished surgeons in France, Germany, America, and England.

Symptomatology. — Before entering into the symptomatology, I ought to premise that there are to be distinguished two forms of the so-called contraction of the palmar fascia : one in which the condition occurs independently of any definite traumatism and tends to multiplicity of lesion, the other appearing as a result of an ordinary wound, and confined to the parts in direct relation to the injury. The first of these I propose to speak of as

¹ “Les doigts, et particulièrement les trois derniers, sont sujets à une flexion permanent involontaire ; à laquelle on a donné le nom de ‘contracture,’ et que quelques auteurs ont appelée en latin ‘*crispatura tendinum*.’” This name is usually attributed to Boyer himself. (“*Maladies Chirurgicales*,” vol. ii. p. 55, first edition, 1826).

true Dupuytren's contraction, the second as traumatic contraction. The characteristics of the latter will be referred to later.

The symptoms of the true form have been so often and so graphically described that little can be added to the current accounts. I shall, then, limit my clinical picture to a simple outline, filled in with a few details taken from the series of examples which have been under my own observation. In a typical case, a middle-aged or elderly man notices in the course of the distal furrow, and directly over the head of the metacarpal bone of the ring or little finger, a small nodule in the skin, or perhaps only a puckering and exaggeration of the flexion line. By-and-by a ridge appears running proximally from this point towards the wrist, and distally along the central axis of the finger. The ridge is prominent, round, and very hard, especially between the flexion fold and the root of the digit, and the skin is usually drawn to it tightly at the seat of the initial sign. It passes on to the front of the first phalanx, nearly always preserving the central position, but spreading out and usually sending processes to the deep surface of the integument as it reaches the first joint of the finger, and as it contracts, draws down the metacarpal phalanx towards the palm. After a while the second phalanx may become bent in like manner, and by exception even the distal bone. The articular structures

show no trace of disease, the tendons are normal, the finger retains all its strength within the progressively narrowing range of motion left to it by the disease, and the utility of the hand may for a long while be little impaired. Sooner or later other fingers may become involved, and the affection may appear in the opposite hand, to follow a like course. The process of contraction is slow in progress, perhaps extending over ten or twenty years; it is painless, and is uncomplicated by any signs of active inflammation. At length, after a more or less protracted period, it may terminate spontaneously in any of its stages, but the mischief wrought is permanent, and unless the surgeon intervenes, the patient carries it to his grave.

This is the more ordinary course, but the signs show great variety in different cases. 1. The disease may remain limited to the palm, not giving rise to flexion of the finger; this is especially frequent in women. 2. Any or all of the fingers may be attacked, and the rigid bands may implicate also the thenar and hypothenar eminences. 3. Either or both inter-phalangeal joints may become flexed, while the metacarpo-phalangeal joint remains free. 4. The palmar cord may remain single and central, or it may send off a lateral branch on either or both sides in the interdigital web, and so implicate two or three fingers. 5. A central band, after reaching the root of the finger, may bifurcate, sending a branch to either

side of the digit; this, in my experience, is the least common variety. 6. The cord, instead of running along the central axis of the finger, may pass towards the inter-digital cleft and then divide, giving branches to two digits; a band of this kind would be in dangerous relation to the digital vessels and nerves in the event of operation by excision. (Fig. 1.)

The statistics as to fingers affected in my series of cases correspond closely to those already published by Adams, Keen, and others. They are as follows: Thumb, four times; index finger, three times; middle finger, twenty-two times; ring finger, thirty-nine times; little finger, twenty-eight times (these numbers include the purely palmar bands where they were placed over the metacarpo-phalangeal articulation, but had not yet led to contraction of the digit; traumatic cases are excluded). The most common association where more than one digit was affected was that of the ring and little fingers; when a single finger was attacked, it was most frequently the fourth. The flexion involved in almost equal proportions the metacarpo-phalangeal joint alone, and this together with the first inter-phalangeal joint. In four cases the first inter-phalangeal joint was contracted, while the metacarpo-phalangeal articulation was free, and in one case the distal joint alone was flexed, although the band extended from the palm. In only two cases were all the

fingers implicated. The condition was bilateral in twenty-four cases out of thirty-nine, right-handed

FIG. I.

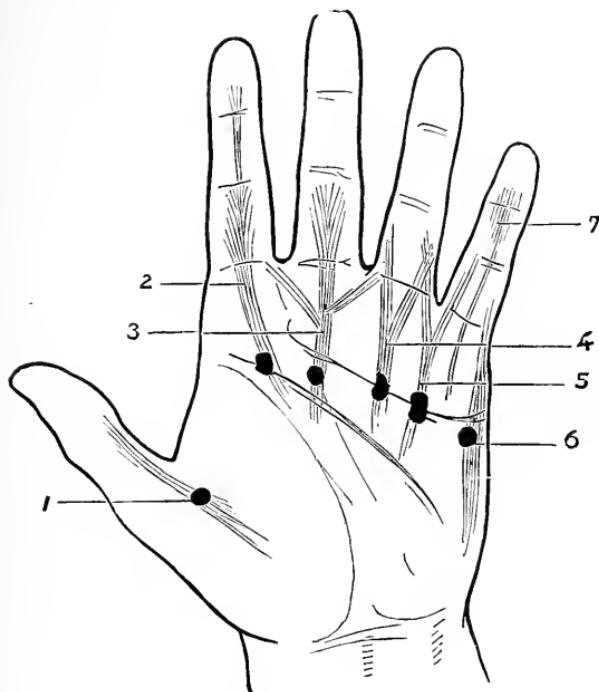


Diagram showing the various types of the abnormal bands in Dupuytren's contraction. The position of the initial lesions over the heads of the metacarpal bones and opposite the flexion lines is indicated by the black spots. 1. Thenar band; 2. Axial band extending to distal joint; 3. Axial band giving off lateral branches to adjoining fingers; 4. Axial band bifurcating to send branches to sides of finger; 5. "Interosseous" band bifurcating to join two adjacent digits; 6. Hypothenar band; 7. Band more developed at distal than at proximal extremity, and leading to contraction of first or second interphalangeal joint, the metacarpo-phalangeal joint remaining free.

in ten, and left-handed in five. Thus the right hand was attacked thirty-four times, and the left twenty-nine times. Of the twenty-four bilateral

cases, nine were worse in the right hand, six in the left ; in the rest the severity differed little on the two sides. Nearly one-third were unsymmetrical as to the fingers attacked. In eight patients, six of whom were women, the band was purely palmar, and did not cause any contraction of the fingers.

Two interesting points to be especially noted in reviewing the series were—first, the tendency to multiplicity of the initial lesions ; and, secondly, the close coincidence of their position with that of the heads of the metacarpal bones. In no case did the disease commence in the finger itself. These facts probably have a bearing upon etiology. In only one instance was there any association with a corresponding disease of the sole.

The inconveniences resulting from the affection are less urgent than might have been expected, partly because the flexion power remains, partly because there is no pain, and partly because the contraction seldom attains an aggravated form until an age when æsthetic considerations are of minor importance and the more active period of working life is drawing to a close. In some extreme cases, however, the nail of the contracted finger may press against the palm, and cause ulceration, and in one instance brought under my notice by a friend the deformity was nearly the cause of a fatal accident, the bent finger becoming hooked in the handle of a moving railway carriage in such a

manner that it could not be disengaged. The patient saved himself by seizing a pillar, while the traction force tore asunder the diseased fibrous bands and set the straightened finger free. It is needless to say that the benefit of the impromptu operation was limited to the immediate service rendered.

The *frequency* of the complaint is difficult to estimate. With a view to forming some opinion as to its prevalence in the poorer classes I took advantage of the kindness of Mr. J. Lunn of the Marylebone Infirmary, Mr. Percy Potter of the Kensington Infirmary, Dr. A. H. Robinson of the Mile End Infirmary, and Dr. S. G. Litteljohn of the Central District Schools at Hanwell, to select cases from the large body of patients in the institutions under their control; and in the cases of Kensington and Mile End I had also the privilege of access to the workhouses in connection with the infirmaries. The total numbers of the persons thus open to investigation were 2600 adults, and 800 children under the age of sixteen. All of these were carefully examined, and every example of Dupuytren's contraction (as well as of the other conditions included in these lectures) was systematically recorded. Of the 2600 adults, of whom about five-sixths were over middle age, 33, or 1·27 per cent., were found to be suffering from various stages of the affection, while in the 800 children no trace of the disease was to be

detected. This proportion is very much smaller than that discovered by Mr. Noble Smith, who was fortunate enough to detect no fewer than 70 examples in 700 persons. His facts and deductions have been fully discussed at the Royal Medical and Chirurgical Society and in the medical papers.

Sex.—The influence of sex is very noteworthy, but much less than was formerly conjectured. Cases of any degree of severity in the female are rare, but the slighter forms are fairly common. Of thirty-nine non-traumatic cases, twenty-five were in men and fourteen in women, but of the latter number in only eight was there any contraction of the fingers. This proportion is larger on the side of the female sex than that given by Dr. Keen in the valuable series analysed by him in 1882 (20 females to 106 males); but it must be pointed out that most of the cases in my list would have escaped notice altogether without a close examination of the palm.

Age.—True Dupuytren's contraction is almost essentially a disease of middle or later life at its onset. It was estimated by Dr. Keen that about five-sixths of the cases began after the age of thirty, but his examples included some of the traumatic form, which may of course originate at any period of life. In my own series only one, a man of thirty-two, was below the age of forty when the disease first appeared, and in the number

seen in hospital practice before I began to keep notes of the cases, I do not recollect one in which the symptoms commenced in youth or early adult life. My friend Surgeon-Captain A. H. De Lom, has kindly obtained for me some statistics that bear very directly upon this point. He finds by reference to the Army Reports that in a force averaging 203,000 soldiers, between the ages of seventeen and thirty-five, only three cases of contraction of the fingers came under treatment in five years (1885-89), and it is not certain whether these were of the traumatic or of the specific variety. It is of course possible that some incipient cases escaped attention, but the magnitude of the figures gives a value to the record in spite of this source of fallacy. It is stated, however, that exceptions to the rule do occur, and that conditions bearing a resemblance to true Dupuytren's contraction have been seen in childhood, and some of these are even believed to be congenital; but it is probable that a closer examination of such cases would prove them to be of a different pathological nature. There appears to be no limit to the period of onset in the other direction. In eighteen cases in my list the disease was unnoticed until after the age of sixty, and in six of these it did not appear until the eighth decade; and it is significant that the majority of these patients, a portion of whom were women, had given up laborious employment before the symptoms appeared.

Class and occupation.—It is very difficult to obtain any information of statistical value as to the proportionate distribution of the complaint in the “classes” and “masses,” and there is great difference of opinion upon the question amongst our best authorities. It is at any rate certain that our workhouses contain a considerable number of examples, and that the disease is also very often found in men and women of the educated ranks. The same doubt exists with reference to the influence of occupation, but there is no question that the earlier observers greatly exaggerated the importance of this factor. It appears, indeed, that in various callings which involve much rough treatment of the palm the affection is even less common than in the rest of the community. Its infrequency amongst soldiers has been already remarked, and Mr. Johnson Smith informs me that it is very rare amongst sailors. In about two hundred patients at the Seamen’s Hospital, whom he was kind enough to examine in order to put the question to the test, only one example of the disease was found, and this was probably of traumatic origin. Shoemakers have been said to suffer frequently, and for mechanical reasons, but there seems to be no substantial foundation for the belief. I have only met with one of the craft so affected, and by a somewhat curious coincidence the disease was of older date, and more severe in the left hand than in the right. This man told me that he had never

seen or heard of the complaint amongst his fellow workmen. Two of the worst cases in my own series were in clerks. With reference to the question of occupation, it may be remembered that the affection is bilateral in nearly two-thirds of the cases, and that the left hand is affected almost as frequently as the right—in my own cases in the proportion of six to seven. This and the other facts named would appear to negative the view that mere friction and pressure of the palm by tools or other objects habitually held within the hands can account for the disease. On the contrary, it is possible that habitual rough usage of the hands, by leading to epidermic thickening, protects the deeper structures; and that the horny-handed toiler is proportionately less liable to the disease than his more fortunate and more tender-palmed fellow citizen. Nevertheless, when the condition has once started it is likely that its progress would be hastened by any external source of irritation, and hence the strong conviction of the sufferers as to the mechanical origin of their deformity.

Constitutional condition.—If a generalisation would be permissible solely upon the cases in my own list, I should be inclined to think that the patients were rather above than below the average in health. Twenty-six out of the thirty-nine had passed threescore and ten when they came under my notice, and with four exceptions all were in

good physical condition, and one (a woman with fairly well-marked contraction in both hands) had reached the span of ninety-three years. In each case careful inquiries were made with reference to the inheritance or past or present existence of gout, rheumatism, and rheumatoid arthritis, and the result, confirmed as far as possible by direct examination of the patients, was altogether contrary to my preconceived notions on the subject. Of the whole number, only one had suffered from gout, one from rheumatic fever, three from rheumatoid arthritis (all in women, whose Dupuytren's disease was limited to slight palmar lesion), and six from mild subacute or chronic rheumatism. A possible gouty inheritance was traced in three cases. All were free from nervous disorders except two of the women, who were subject to neuralgias of an ordinary kind, and one (aged seventy-three) with a double contraction of thirty years' standing, who was suffering from hemiplegia of three years' duration. No complaint as to the digestive functions was made in any case.

The evidence brought forward by different observers with regard to constitutional tendency appears to be extremely conflicting. Thus, Dr. Keen, whose contribution is one of the most careful records we possess, found no fewer than forty-two gouty patients out of forty-eight cases; and Mr. Adams expresses his opinion that the disease is a gouty thickening of the palmar fascia.

Dr. Abbe of New York, on the other hand, has noticed a remarkable frequency of nervous symptoms in connection with Dupuytren's contraction, and believes that the complaint is of neuropathic origin, while other surgeons have in like manner assigned to rheumatism, rheumatoid arthritis, alcoholism, and other conditions an important causative relation with the disease. There is, of course, no doubt that such widespread affections as gout and rheumatism, neuroses and alcoholism are present in certain cases—it would be strange were it not so ; but it is noticeable that the writer who gives a prominent place in the causation to any one of these conditions always holds the claims of the rest in very low esteem ; and it appears probable that the associated constitutional tendencies noticed in the different groups of cases depended rather upon the particular class or set from which the observer drew his patients than upon any essential connection between the local and internal affections. My own experience of the disease has been based principally upon cases in hospitals, and hence the remarkable absence in my series of the neurotic or gouty predispositions that might have appeared in persons whose worldly circumstances favoured either of those conditions.

Habits.—In my inquiries as to habits, the usual difficulty of obtaining trustworthy replies was experienced. Three of the more severe cases pleaded guilty to long-standing intemperance, but

the rest all regarded themselves as moderate drinkers—an elastic term. There was, however, nothing in their general condition to indicate that alcoholism had exercised any material influence in favouring the palmar lesion.

Race and climate.—We have at present no statistics with regard to the effects of race and climate upon the disease; but so far as we are at present informed it must be rare, if not altogether absent, in certain countries. During my own residence of six years in Japan I did not meet with a single instance; and the far larger experience of my friend Surgeon-General Takaki has been equally negative as to this particular affection. My friend Surgeon-Colonel Owen tells me that in an extensive experience amongst the natives of Bengal, Central Asia, and Afghanistan, he does not recollect more than one or two cases, and that these may have been traumatic. At any rate, the condition is extremely rare.

Inheritance.—There is unquestionably a strong predisposition to the disease in certain individuals and families, and so many examples of hereditary transmission of the tendency have been related that it is useless to add further to the list. We can no more explain the cause of this special predisposition than we can account for the idiosyncrasy which renders certain persons inordinately liable to erysipelas and some other affections; and although Dupuytren's contraction is often asso-

ciated with such widespread complaints as gout, rheumatism, and various neuroses, its relation to these is probably to be regarded as a coincidence.

Morbid anatomy.—It has long been a subject of dispute whether the complaint is or is not a contraction of the palmar fascia. There is, of course, no doubt that the palmar fascia is always implicated to some extent, but its exact relation to the morbid tissue that constitutes the essence of Dupuytren's disease can only be decided by a consideration of the anatomy of the healthy structure.

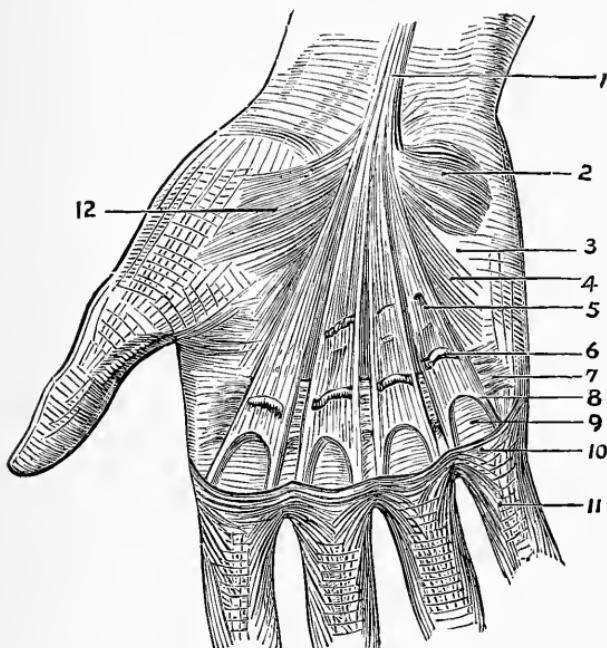
It is perhaps not easy to say what is meant by the expression "palmar fascia," since the text-books are by no means agreed upon the point. We have really to notice four palmar structures which may claim a share in the title. These are (1) the radiating fascia, spreading towards the fingers from the palmaris longus and annular ligament; (2) the aponeuroses investing the muscles of the thumb and fingers; (3) a delicate connective tissue blending with 1 and 2 and forming sheaths for the flexor tendons, the lumbrales, and the digital vessels and nerves; (4) the fascia of Gerdy, which runs transversely across the bases of the second, third, fourth, and fifth fingers and in the inter-digital webs, and is continuous with the superficial fascia of the digits and dorsal surface of the hand. Lastly, in addition to these,

we might regard the ligamenta vaginalia and the transverse ligaments connecting the metacarpo-phalangeal articulations as specialisations of the family. We are, however, mainly concerned with the radiating fascia and fibres of Gerdy.

The *radiating fascia* consists of a strong fibrous expansion extending subcutaneously from the anterior annular ligament and palmaris longus tendon, and consisting of an outer or thenar portion, spreading over the muscles of the thumb and blending with the muscular aponeurosis; an inner or hypothenar portion similarly related to the muscles of the little finger; and a central digital expansion which is derived almost entirely from the palmaris longus when this is present, but is well developed even when the muscle is wanting. The central portion spreads out in a fan-like manner as it approaches the fingers, giving off some strong fibres from its anterior surface through the palmar fat to the connective tissue of the superjacent corium, especially in the situation of the palmar folds, and attached by its deep surface to the delicate fascial investment surrounding the tendons, vessels, and nerves; finally, a little beyond the middle of the palm it divides into four segments, one for each digit, each of which soon breaks up into two lateral bands that embrace the sides of the metacarpo-phalangeal joint to blend with its ligaments and the periosteum of the first phalanx, and running on become similarly

connected with the first inter-phalangeal joint and middle phalanx. Where the four digital bands diverge they are joined together by deep

FIG. 2.



THE PALMAR FASCIAE.

1. Palmaris longus tendon ; 2. Palmaris brevis ; 3. Muscular aponeurosis of hypotenar eminence ; 4. Fibres from radiating fascia to hypotenar eminence ; 5. Innermost digital portion of central segment of radiating fascia ; 6. Fibrous band passing to integumental fold ; 7. Transverse fibres appended to radiating fascia ; 8. Lateral digital branches of radiating fascia ; 9. Portion of vaginal fascia exposed between 5 and 10, Fibres of Gerdy ; 11. Superficial digital fascia continuous with fibres of Gerdy ; 12. Thenar portion of radiating fascia blending with muscular aponeurosis.

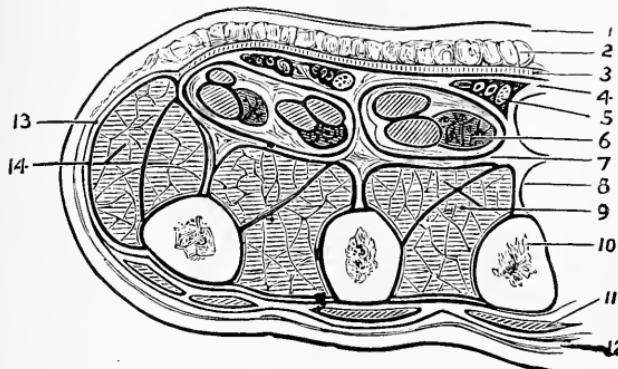
transverse fibres which pass from the inner to the outer border of the hand, blending in these situations with the muscular aponeurosis. (Fig. 2.)

The *transverse fibres of Gerdy* are really the proximal portion of a superficial fascia which invests the whole of the four inner digits immediately under the skin, forms the subcutaneous web of the fingers, and is continuous posteriorly with the superficial fascia of the back of the hand. As seen in the palm, it consists of loose fibres intermingled with fat, running for the most part in a transverse direction from the second to the fifth metacarpo-phalangeal joint. Proximally it presents a somewhat sharply defined free border placed nearly opposite the joint fissure, and extends distally, as before stated, to the fingers and the inter-digital web, and is connected with the deeper tissues by a few fibres, but is for the most part separated from them by loose, whitish fat. On the fingers the tissue constitutes a sheath investing the tendinous, bony, and ligamentous structures and the lateral bands derived from the radiating fascia. It takes the form of a distinctly membranous sheet dorsally and at the sides, but in front it appears as a coarse irregular network supporting the digital vessels and nerves, and containing a large quantity of fat in its meshes. It is connected strongly with the corium, especially at the palmar folds, and more loosely with the deeper structures by fine fibres.

Between the proximal border of the fibres of Gerdy and the point of bifurcation of the digital

bands of the radiating fascia is a space about half an inch in length, in which is seen a portion of the *vaginal fascia* that invests the tendons, vessels, and nerves in the palm. (Fig. 3) The connective-tissue fibres in this latter are for the

FIG. 3.



TRANSVERSE SECTION OF HAND THROUGH THE THIRD, FOURTH,
AND FIFTH METACARPAL BONES.

1. Palmar integument ; 2. Fat transversed by fibres from 3 ;
3. Radiating fascia ; 4. Vaginal fascia, superficial portion ;
5. Palmar vessels and nerve ; 6. Flexor tendons and lumbricales ;
7. Vaginal sheath blending with fascia of interossei ;
8. Septal fibres from vaginal fascia to bone ; 9. Interossei ;
10. Middle metacarpal bone ; 11. Extensor tendon and sheath ;
12. Superficial fascia beneath dorsal integument ;
13. Fascia of hypotenar eminence ; 14. Muscles of little finger.

most part transversely arranged. They are connected superficially with the deep surface of the radiating fascia, where they lie beneath it, and deeply with the aponeuroses of the interossei, transverse metacarpal ligament, and glenoid plates, and form septa between the flexor tendons of the four fingers. Where they ensheathe the tendons

above the ligamenta vaginalia they are separated from them by a kind of lymph space.

If we examine a case of Dupuytren's contraction in the light of our anatomical knowledge, we shall be struck by the circumstance that the morbid structure which causes the permanent flexion of the fingers bears no resemblance in position or character to the normal fibrous tissues of the part, although it is apparently continuous in the proximal direction with the digital bands of the radiating fascia. The band is best developed beyond the point where the radiating fascia normally ceases, and maintains its longitudinal fibrillation while crossing the vaginal fascia and the transverse fibres of Gerdy. The varieties and modes of branching already described are only to a limited extent related to the anatomical arrangements—that is, where the morbid tissue spreads proximally over the radiating fascia, and sends lateral branches along the course of Gerdy's fibres; but it is certain that the tendon-like cords are of entirely new formation, and that they exist at the expense of the normal structures. The well-known preparation in St. Bartholomew's Hospital, which has been figured by Mr. Adams, affords a demonstration of this, as the band, instead of following the direction of the radiating fascia, runs towards the interdigital cleft and there bifurcates, sending branches to the adjacent sides of two fingers. In a specimen of my own the band runs axially to the little

finger and spreads out in front of the first phalanx as a fatless fan-like expansion, that differs altogether in character and arrangement from the normal subcutaneous tissue and becomes closely connected with the skin, the structure of which, however, remains unchanged. The firmest point of integumental adhesion is opposite the distal flexion fold over the head of the fifth metacarpal bone. The first phalanx is flexed to about 90° , and over the metacarpo-phalangeal joint the contracted cord lies in a plane considerably anterior to the tendons, vessels, and nerves, all of which maintain their normal relation to the bones and muscles. There is no tendency on the part of the morbid growth to follow the deep connections of the fascia in the palm.

The radiating fascia, and perhaps even the tendon of the palmaris longus, are made tense and prominent by the shrinking of the new material, but the palmaris longus has no primary share in the production of the deformity, and in fact the disease may be present where the muscle is undeveloped. Repeated experience in operations has proved that the flexor tendons are not affected, and that even in long-standing cases the joints may be fully extended immediately after the division of the morbid fibrous bands. It may be accepted as a principle that the development of a tendon once completed, the tissue has little or no disposition to retrograde changes in

the direction of its length. When the most prominent parts of the contracted cords are exposed for excision they bear much resemblance to tendon in contour and striation, but they are less bluish and lustrous in aspect. On dissecting them away from the radiating fascia the transverse fibres interlocking the digital segments of the latter may often be seen unchanged, and in one case in which the disease had attacked the sole the new fibrous tissue could easily be detached from the fascial fibres, which retained all their lustre.

The histological appearances of the new growth are those of fibrous tissue. If the disease is spreading, the fibrous strands are intermingled with nuclear proliferation, which extends especially along the course of the vessels.

Pathology.—The study of the character and relations of the diseased structure indicates that it is an inflammatory hyperplasia commencing in the skin and subcutaneous tissue of the palm, involving the fascia secondarily, and replacing the adipose connective tissue which normally serves as an elastic cushion for the palmar surface of the hand and fingers. It must now be considered what is the cause of the morbid process. The view of Dupuytren has already been referred to. He believed that the affection was provoked by repeated injuries of the palmar fascia by pressure and friction from implements used habitually in different mechanical callings ; but the facts I have

adduced in the discussion of the etiology conflict strongly with the hypothesis. It has been shown that in artisans both hands may be equally affected where only one is brought in contact with the tool, that aggravated forms of contractions may appear in persons who are not at all exposed to any such habitual source of irritation, and, moreover, that the disease appears to be of less than average frequency in certain employments in which the palms are subject to an unusual degree of friction.

Some source of irritation, however, must be present, and it has been suggested that this is to be found in gouty deposits. In one case recently brought forward by Mr. Lockwood, uric acid crystals were actually present in connection with the bands; but this experience is exceptional. That the new tissue might become the seat of such a deposit in gouty subjects is more than probable, but in the majority of cases of Dupuytren's contraction seen in this country the patients are not, and have not been, subject to gout. It would, moreover, be difficult to find any condition that presents less resemblance in its course and tendencies to known manifestations of the gouty poison. The changes, indeed, are much more suggestive of chronic rheumatism than gout, but even the probability of this source of origin is not supported by observed facts. The situation of the initial lesions, and the peculiar tendency of the new growth to feed like a parasite upon the

tissues in which it spreads and which it replaces have led me to believe strongly that the active cause of the disease is a chronic inflammation probably set up by a micro-organism, which gains access to the subcutaneous tissue through accidental lesions of the epidermis overlying the bony prominences formed by the heads of the metacarpal bones. This would explain better than any existing hypothesis the persistent course of the disease and its proneness to recur after the most skilfully devised operation, while the almost constant limitation of the disease to the declining years of life corresponds mainly to lessened resistance in the bodily organism, and partly perhaps to senile absorption of the palmar fat cushion and atrophy of the protective thickening of the epidermis. The almost complete immunity of the foot is accounted for by the protection afforded by the shoes and stockings. Individual and inherited susceptibilities are exemplified here as in other complaints of known bacterial origin. To determine the question I have sought the experienced aid of my colleague, Mr. Shattock, in carrying out a series of bacteriological researches.

In a patient in whom it was decided to excise the contracted tissue in two hands the more recently affected member was selected for experiment. The skin was incised under strict antiseptic precautions, portions of the growing tissue were cut away with the aid of a knife and forceps,

sterilised by heat immediately before use, and the fragments excised were at once placed in cultivating tubes of agar-agar and gelatine. In a second case a commencing nodule upon the plantar fascia of a patient, suffering also from Dupuytren's contraction of the hands, was treated in a similar manner. In Case 1 two of the three fragments quickly showed a growth obviously due to contamination. On the third and fourth days a yellow nodule appeared in all three specimens, and on cultivation assumed a form which led us to believe that a specific organism had been isolated ; but on making a cover-glass preparation of this it proved to be merely a form of yellow sarcina. In the jelly tube containing one of the original pieces of tissue, and in the agar tube a second growth, *micrococcus candidans*, subsequently developed, and a like growth appeared in Case 2. It is desirable that these experiments should be repeated ; but it must not be assumed that negative evidence necessarily disproves the agency of organisms ; partly because our present means of detection are not yet perfected, and partly because the tissue examined may merely offer the result of a morbid process that has already come to a natural termination. Sections from Case 1 stained with fuchsin and by Gram's method showed no organisms as viewed under $\frac{1}{2}$ homogeneous immersion.

False Dupuytren's contraction.—There is a

form of digital contraction usually classed with that just described, but differing from it in origin and several other respects. It is always due to obvious traumatisms, such as incised or lacerated wounds, involving the palmar or digital fascia. The age at which the lesion begins is governed by the period of injury, and hence the condition is as common in childhood and early adult life as in middle or old age. The seat of initial lesion is single, and the affection is confined to the injured hand, not tending to appear subsequently in other parts of the same hand or in the opposite member, as in most examples of the ordinary form. The contraction progresses rapidly to a certain point, and then ceases to get worse. It rarely becomes so strongly marked as in the worst cases of the true Dupuytren's disease. The contracted band, starting from the point of injury (which is indicated by an ordinary scar) has seldom the tendon-like form of the well-marked "Dupuytren," the characteristic puckers in the skin are represented only by ordinary cicatricial adhesions, and the digital extensions are usually in the form of one or two lateral bands following the bifurcation of the digital process of the radiating fascia. Lastly, the effect of operation is different. Subcutaneous division is less efficacious when the skin is extensively implicated in the cicatrix, and the excision of the band or the transplantation of a flap after division of the cicatrix is not followed by

the strong tendency to recurrence observable after similar proceedings in the true form. In all the seven cases in my list the nature and traumatic origin of the disease could be recognised without difficulty.

A subcutaneous cicatricial contraction of the finger may also result from violent and sudden super-extension of the joint. The lateral bands extending from the radiating fascia are ruptured, and if the finger is not kept straight by mechanical appliances a contraction of the joint is liable to occur. In such cases the resistance to extension is felt to depend upon two tense lateral bands, while the movements of the articulation in the direction of flexion remain strong and normal.

Treatment. — Some eighty years ago Baron Boyer, speaking of the disease now under consideration, said that it had been advised to expose and divide the contracted tendon, and even to excise a portion, afterwards keeping the hand extended upon a splint; but, he remarks, “Le succès d'une telle opération est trop incertain; elle n'a probablement jamais été pratiquée et un chirurgien prudent devra toujours s'en abstenir.” It was he who expressed the congratulatory belief that surgery had already in his day reached its final limits, and all that had then not been accomplished could scarcely be regarded as attainable. For many years after his time it cannot be said that the treatment made any real progress. It is

true that Sir Astley Cooper advised subcutaneous section of the contracted bands, but the suggestion was not carried into practice till much later, when Dupuytren, having decided that the tendons were not affected, did what Boyer considered unpermissible, cut the contracted cords and superjacent integument, and straightened the hand upon a splint. The results appeared to fully justify the remarks of his predecessor, for under this treatment the gaping wound suppurred; and if the patient recovered without loss of the hand the process of cicatrisation at length restored the deformity in a more hopeless and distressing form than before. A few years afterwards Goyrand recommended an improved method: that of exposing the tense bridle of morbid tissue by a longitudinal incision, dividing it, and then re-uniting the edges of the cutaneous wound; and this plan was adopted with various modifications by other surgeons. The absence of antiseptic precautions, however, exposed the wound to all the dangers of infection, and as the treatment mostly failed to secure the advantage hoped for it fell into disrepute, and patients were usually dissuaded by their friends, and even by their medical attendants, from submitting to any operative measures. It is to Jules Guérin that we are indebted for the first demonstration of the value of the subcutaneous method proposed by Sir Astley Cooper, and the practice was carried out in

this country by Messrs. Tamplin and Lonsdale, and perfected by Mr. William Adams. For a time the subcutaneous operation held its ground without a rival, but the introduction of the anti-septic principle in surgery rendered it possible to reconsider the discredited open method, and the plan was revived with various modifications by Kocher, Busch, Hardie, and others, with encouraging though variable results.

The therapeutical measures now eligible may be briefly enumerated :

Non-operative treatment.—There is no doubt that in the milder cases and when the morbid process has come to a standstill, a considerable improvement may be effected by massage and persevering extension. I have seen in a patient of seventy the fourth and fifth fingers brought from an angle of 90° with the palm nearly to a straight line within a year, but the contraction relapsed completely in three months, when a severe illness made it necessary to suspend the treatment.

We have heard much of the wonders effected by hypnotism during the latter days, but the surgeon hardly expected to be told that Dupuytren's contraction, of all diseases, could be cured by "suggestion." Yet in a recent volume of one of our medical journals we find a practitioner gravely claiming a successful result for this treatment in a case of the kind ; a curious demonstra-

tion of the survival, at the end of the nineteenth century, of the peculiar mental condition that brought patients to the feet of Greatrakes and Perkins in a bygone generation.

The *Operative measures* may be divided into three classes : subcutaneous, open, and plastic.

The *Subcutaneous method* deserves the first place. Mr. Adams's operation consists in the subcutaneous division of all the contracted bands of fascia which can be felt ; "the bands to be divided by several punctures with the smallest fascia knife passed under the skin and cutting from above downwards, followed by immediate extension to the full extent required for the complete straightening of the fingers when this is possible, and the application of a retentive, well-padded, metal splint from the wrist along the palm of the hand and fingers ; the fingers and hand to be bandaged to the splint. When the full extension cannot be safely made, it must be carried as far as possible without tearing the skin." This plan I have followed, with slight variations, but I have found it easier, after making the preliminary puncture (which should be longitudinal in direction to prevent gaping during the subsequent extension), to pass the knife beneath the band and to cut from within outwards, except in places where the deep surface of the skin is very tightly adherent, and the little wounds are sealed with cotton wool impregnated with collodion and

dusted over with iodoform. The sensation conveyed to the operator by the division of the round palmar cords is very similar to that experienced in tenotomy, and the effect of each section is immediate and encouraging. In some examples, however, the morbid tissue has become so firmly blended with the corium, especially over the proximal phalanx, that a satisfactory division is difficult, or even impossible; and if the extension be carried too far ominous fissures begin to appear in the rigid integument. When this happens the surgeon, if wise, will be satisfied with whatever he has been able to achieve, without proceeding further at the time. The splint extension may be immediate or deferred. Where the skin has held good there is no reason why the fingers should not be put in position at once and fixed in place by a splint of plaster of Paris or other material; but if it be evident that the integument at any point has been severely strained, it is desirable to wait for a few days before the parts are put on the stretch, and there is no reason to believe that the delay will be attended by any disadvantage. The operation may with benefit be preceded by careful washing of the hand and packing with a weak solution of perchloride of mercury solution or other antiseptic, and antiseptic dressings should be applied until the incisions are completely healed.

The after-treatment consists in the use of

splints of various forms. The palmar splints of Mr. Adams are very convenient, but in the early periods plaster of Paris is equally satisfactory, and renders the intervention of the instrument-maker unnecessary. Whatever form be adopted it should be worn day and night for two or three weeks, and then be replaced by a well-moulded front splint of sheet iron, to be applied at night only, and kept in use for several months. The hand once set free during the day the patient is to be urged to practise friction, with passive extension and active movements of the joint, at every possible opportunity; and it is only by strict attention to these rules that permanency of the improvement can be ensured. In private practice the instructions are usually carried out with a good will, and hence relapses are exceptional. Mr. Adams and Mr. Macready estimate them as less than ten per cent. But in hospital practice the case is different. The artisan has seldom much leisure or inclination for unpleasant manipulations for which, despite the assurances of the surgeon, he sees little immediate necessity, and he frequently allows the hand to drift into a condition, which, if not worse, is at least little better than before.

The *Open operations* may be placed under two separate headings—one in which the bands are merely divided in one or two places, and the other in which the morbid tissue is excised as far

as possible. The first of these, however—the original method of Goyrand—may now be held as superseded, since it has neither the safety of the subcutaneous method nor the thoroughness of the more radical measure. We need therefore only discuss the latter. The cutaneous incision may be either longitudinal and linear, as practised by Goyrand, Kocher, and others, or V- or Y-shaped, after the method of Busch, Madelung, and Richer. In any case the reflected skin should be very gently dealt with, and the wound carefully closed after the removal of the diseased bands. In most instances the simple linear incision gives all that is required, but the other varieties are useful when the distal end of the band branches or expands. The isosceles flap of Busch is made with the base opposite the metacarpo-phalangeal joint, the apex at the distal extremity of the hollow of the palm. (Fig. 4.) When the hand is extended after section or excision of the contracted tissue the apex of the flap is drawn away from the angle of the incision, and the wound when closed assumes a Y-shape. A Y-incision, with the fork over the first phalanx, and the stem corresponding to the palmar cord, is of advantage where the fibrous band spreads out broadly and becomes adherent to the skin beyond the metacarpo-phalangeal joint, the reflection of the angular flap within the fork allowing the safe removal of the diseased tissue. In any of these operations the anatomical

relations of the vessels and nerves should be carefully borne in mind. Fortunately the morbid tissue seldom encroaches upon the nerve tracts in such a way as to expose them to danger. The

FIG. 4.

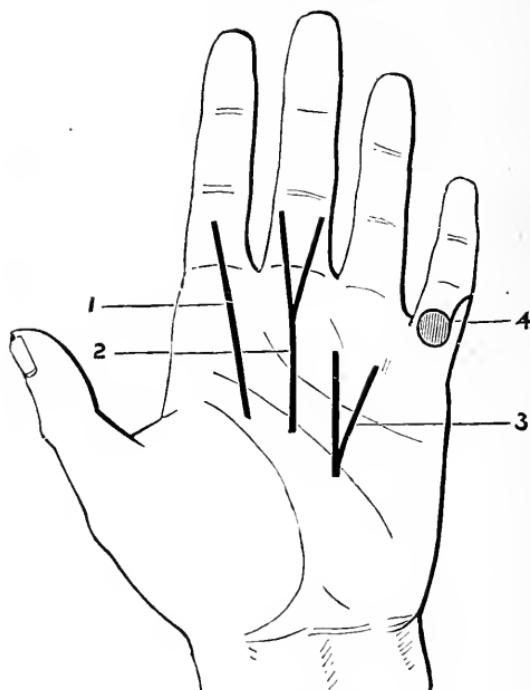


DIAGRAM SHOWING INCISIONS FOR OPEN AND SMALLER PLASTIC OPERATIONS.

1. Straight incision (Goyrand);
2. Y-incision modified to allow incision of digital expansion of band;
3. V-incision of Busch;
4. Position of flap to fill gap left by section of contracted band and superjacent integument (Author's method).

best rule for the surgeon is to confine his dissection as far as possible to the tissue overlying the axes of the flexor tendons, and not to make any further lateral excursion than is absolutely necessary.

Extreme care, however, will always be needed in excising cords which run towards the interdigital web, as these lie directly over the nerves. The tendons are quite safe in the palmar incisions, as they lie much deeper than the fibrous cords, but the diseased tissue is closely related to the thecæ in the fingers. The after-treatment is similar to that recommended for the subcutaneous operation, but for obvious reasons the necessity for antiseptic precautions is more vital in the open method. No drainage is required.

Plastic operations may be conducted under the same principles as those which guide the surgeon in the treatment of cicatricial contractions from burns or other causes. In cases of contraction at the metacarpo-phalangeal joint, where the skin is greatly involved, I have made a transverse incision through the integument and fibrous cord at the root of the finger and filled up the wide gap left on extending the joint by the transplantation of a flap from the side of the digit. (Fig. 5.) The dissection of the flap must be carefully conducted in order to avoid injury to the digital nerves. The result is usually good and permanent. In some cases it might be permissible to carry the plastic principle still further by the transplantation of a flap on the Tagliacotian principle from the chest or upper arm or any other convenient point; or the more simple resource of grafting, after the manner of Thiersch, may be employed with advan-

tage, as it has been proved to have a remarkable effect in lessening cicatrical contraction.

Of these various procedures I believe that the best operation in most cases is the subcutaneous plan. It is speedy and safe, the immediate results

FIG. 5.

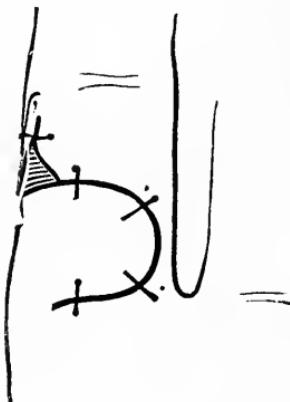


Diagram showing lateral flap transplanted into gap left by division of the contracted band, with the superjacent integument at the level of the interdigital web.

are very satisfactory, the risks of relapse are in my experience less than in the open method, and in the event of a recurrence the other lines of treatment are still available. The open operation involves a more extensive surgical injury, and although it will usually do well under antiseptic precautions, there is a greater risk of casualties. It is perhaps most applicable to the slighter cases, in which the whole of the disease can be removed, but it may also be employed where the subcutaneous plan has failed. The plastic operations

are most useful in the traumatic forms, and in those cases of true Dupuytren's contraction where the skin is so far involved that full or satisfactory extension is impossible. The method I have suggested produces an immediate result, and under ordinary circumstances a long after-treatment is unnecessary, because the flap of integument does not tend to contract. The larger operation can only be called for in very severe cases, where all other measures have failed.

It is not certain in any given example whether the surgeon will be successful in giving lasting relief to the patient. Were it simply a question of dividing or excising a common cicatricial band, there is no reason why the result of every well-devised operation should not be permanent; but experience shows that even with the greatest care it is occasionally difficult to prevent a return of the condition which gave rise to the deformity in the first place—that is, a growth of new fibrous tissue which tends to contract.

The main conclusions arrived at may be stated as follows :

1. There are two forms of disease comprised under the name "contraction of the palmar fascia," the one traumatic in origin, occurring at all ages, and not tending to spread far beyond the seat of injury; the other unassociated with obvious traumatism, tending to multiplicity of lesion, and almost confined to middle and advanced life.

2. The latter condition, the true "Dupuytren's contraction," is not, strictly speaking, a contraction of the palmar fascia, but consists of a chronic inflammatory hyperplasia, commencing in the corium and subcutaneous connective tissue, involving secondarily the palmar fasciæ, and tending to the formation of dense bands of cicatricial tissue which replace the normal structure.

3. It does not appear to be especially connected with pressure or friction of the palm by tools or other objects employed in manual occupations, but is probably caused by infective organisms which gain admission through epidermic lesions, usually located over the prominent heads of the metacarpal bones.

4. It is almost essentially a disease of middle and advanced age, more common in men than in women, occurring in all classes, tending to progress slowly through a long course of years, and liable to recurrence after operation.

5. It is connected with a special susceptibility, inherited or acquired, which cannot yet be accounted for or expressed in any known terms ; but neither gout, rheumatism, rheumatoid arthritis, nor any other of the ordinary constitutional ailments has been proved to have any causative relation to the disease.

6. Cicatricial deformities of the digits resulting from burns and other severe injuries are often of a very distressing character, and especially those

which prevent opposition of the thumb to the fingers. When the joints are not destroyed, the utility of the member may generally be restored by well-devised plastic measures, the new material being either an epidermic graft, or a skin flap taken from a convenient portion of the surface; but it is useless to lay down laws in detail for the treatment of these conditions, as the variations in the extent and position of the loss of substance are so great that only the ingenuity of the operator can guide him in the application of the general principles of plastic surgery.

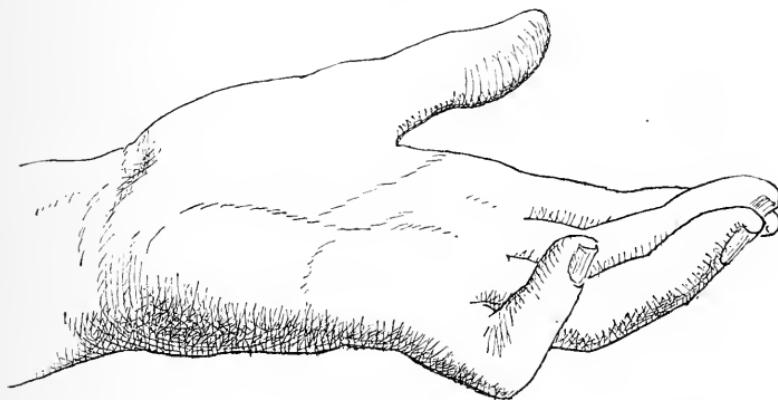
CONTRACTION OF THE FINGERS DUE TO DEVELOPMENTAL IRREGULARITIES IN THE BONY AND LIGAMENTOUS ELEMENTS OF THE ARTICULATIONS.

There are certain affections of the fingers which have hitherto attracted little notice, but are interesting on account of their relationship to deformities of much greater frequency in the lower extremity. These are conditions of abnormal flexion and of lateral deviation of the phalanges at the inter-phalangeal articulations, the first of which corresponds exactly to the well-known deformity of the foot called "hammer toe."

"*Hammer finger*" (Fig. 6) is not a rare complaint, although much less familiar, possibly because much less troublesome, than hammer toe. It may be defined as a permanent flexure of one or more digits, nearly always at the first or second inter-phalangeal joint, and unassociated with inflammatory or degenerative disease in the articular structures, or with any evidence of paralytic or spastic phenomena in the muscles. It is strictly limited in onset to the developmental period, and may manifest itself at any time between birth and adult life, possibly even before birth in some instances. It is more common in girls than in boys. The digit most frequently attacked is the little finger, and the proximal

inter-phalangeal joint is more often affected than the distal joint. It is usually symmetrical. The contraction is slow, progressive, and painless, and becomes arrested spontaneously at any degree of flexion, but seldom goes beyond an angle of 90° . The joint cannot be extended by any ordinary force except in the earliest stage, and even then

FIG. 6.



“Hammer Finger.”

the bent position is immediately resumed after the cessation of the effort. Flexion, on the other hand, is complete and of fair power. No alteration is produced in the deformity by flexion of the wrist, a fact which proves that the main obstacle to extension does not lie in the tendons. There are no contracted fascial bands, and, as a rule, the skin is normal, but occasionally a small longitudinal fold may be present in the angle of flexion. In rare instances the resistance to extension is capable of yielding suddenly with a spring-like action, and

a similar movement recurs as the joint is replaced in the position of flexion. These cases are usually classed with the condition known as "trigger finger." The contraction also occurs in the meta-carpo-phalangeal joint, but very rarely attains a degree marked enough to attract the attention of patient or surgeon. In 800 children examined at the Central District School at Hanwell by Dr. Litteljohn and myself, this affection was found seven times—five times in girls, twice in boys, the ages of the subjects ranging between eight and fourteen. In all these the deformity was confined to the little finger, and in six cases it was bilateral. The proximal inter-phalangeal joint was affected in ten, and the distal joint in three of the thirteen digits. The angle of flexion measured from the prolonged metacarpal axis, ranged between 20° and 80° in the different cases. A contraction of less than 20° was frequent, but the deformity was so slight that the cases were not recorded as pathological. Besides these examples, I have met with several cases in adult women, in whom the defect is said to have originated in early childhood. The little finger was affected in all, but in one the ring finger, and in another the ring and middle fingers were also involved. Only the last was unilateral. The following case may serve as a type of the more troublesome forms :

G. B., a domestic servant, aged twenty-two, was admitted into St. Thomas's Hospital in June 1889, with contraction of

the third, fourth, and fifth fingers of the right hand at the first inter-phalangeal joints. The patient, a strong, healthy girl, quite free from neurotic tendencies, stated that her little and ring fingers had been contracted from early childhood, and that the condition had increased slowly but progressively to the present time. The middle finger became similarly affected about five months before admission. She had never suffered from pain, and the parts had been free from all sign of inflammation ; the deformity, however, caused very great inconvenience in her occupation. Two months before admission an attempt had been made to relieve the flexion of the little finger by subcutaneous section of the fascia, with the result of inducing a traumatic contraction of the metacarpo-phalangeal joint. The family history was negative. On examination the little finger was found to be flexed at an angle of 90° at the first inter-phalangeal joint, and the metacarpo-phalangeal joint was bent at an angle of 120° by cicatricial contraction of the skin and subcutaneous tissue (the result of the operation alluded to). The ring finger was flexed at the first inter-phalangeal joint to about 110° , and the middle finger at the corresponding articulation to about 150° . In the case of the inter-phalangeal joints, the movements in the direction of flexion were quite free and of normal power, but extension was strongly resisted by ligamentous tension at the points named. No increase in the range of movement was gained by flexion of the wrist. A first operation was undertaken for the relief of the cicatricial contraction at the proximal joint of the little finger. The tense integumental band was divided, and after straightening the joint a flap was dissected from the ulnar side of the digit opposite the point of incision and twisted into the gap. (Fig. 4.) The wound united by first intention, and the result was permanent. A week later an operation was performed upon the first inter-phalangeal articulation of the same finger. The lateral ligaments were divided subcutaneously near their proximal attachment, and it was found that the joint could then be straightened by the use of moderate force ; but on the discontinuance of the extension the contraction was reproduced by the elastic tension of the flexor, except during flexion of the wrist. The hand was placed upon a splint. The patient,

who did not bear restraint well, left the hospital, and has since been lost sight of.

There is little doubt that in this case the primary contraction was due to imperfect evolution of the ligaments, and that the shortening of the tendons was secondary. The reason for accepting this order of phenomena is that a pure myogenic contraction does not readily lead to changes in the joint structures, because the articulations are capable of full extension while the flexor tendons are relaxed by bending the wrist, and hence the limitation of movement is not constant. (See Case recorded on page 58.) On the other hand, in a permanent contraction of a finger-joint occurring during the period of active growth the flexors are never stretched to their full extent, and consequently do not undergo their normal longitudinal development; but should such a contraction originate in an adult the case is different, as muscle and tendon show very little disposition to undergo active involution in the direction of their length after their complete development is attained; and hence after division of the abnormal bands in true Dupuytren's disease the tendons do not impede the complete extension of the digit. This law, that joint contractions commencing in youth lead to shortness of muscle tendon, while those beginning in adult life do not, is worthy of the attention of the surgeon.

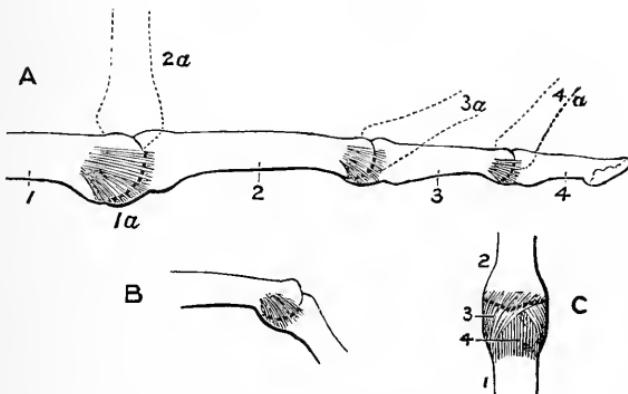
Pathology.—The affection is of some pathological

importance, because it affords a simple test case by which many other questions of larger moment may be decided. It has been demonstrated that the permanent obstacle to extension of the contracted joint is to be found in the ligaments, there is no evidence of either muscular or nervous impairment or of any inflammatory changes in or about the joint, the process of contraction is slow and painless, and the condition always originates and progresses to its maximum during the term of active growth. In order to understand the significance of the complaint, it is necessary to dwell upon some facts in digital anatomy and physiology that have not received the consideration they deserve. If we examine a number of hands, it will be found that there is a remarkable wide physiological variation in the range of movement at the phalangeal articulations in different individuals, and it requires but a small departure outside the physiological limits of variation to constitute the pathological deformity under consideration. The results of my own observations are as follows : (1) At each of the digital joints the distal bone, starting from the position of extreme flexion, passes through a variable number of degrees before it reaches the point at which it is arrested by tension of the ligaments. In the metacarpo-phalangeal joint the angle formed between the two bones during extreme flexion is usually about 80° , and the entire extending movement from this point

may be represented in the healthy hand by any number of degrees between 90 and 190. That is, in one person the motion is arrested a little before the axis of the phalanx reaches a line with that of the metacarpal bone; in another it may be possible to continue the extension until the two bones form an angle with a dorsal opening of 90°. At the first inter-phalangeal joint there is a similar but less extensive variation. The extreme flexion angle is 60° or 70°, and the full extension may be checked as soon as the axes of the two bones are in the same line (frequently a little before this point is reached), or may be carried on 30° beyond. In the distal joint the flexion angle is about 80°, and extension may be checked when the two bones are in the same line, or may be capable of continuation for 40° or more. In the thumb the range of movement at the metacarpo-phalangeal joint varies from 80° to 170°, and at the inter-phalangeal joint from 90° to 120°, in different persons—*i.e.*, the physiological variation in the two articulations is 90° and 30° respectively. The diagram (Fig. 7) may help to render this clear. It is not only in different individuals that such variations are apparent, but the fingers of the same hand and corresponding fingers in opposite hands may differ from each other to a marked degree in range of extension. The super-extension is usually greatest in childhood, and undergoes great diminution as adult life is approached,

although in many cases it is persistent; as a rule, however, the limitation is in direct proportion to the strength of the hand, and is hence nearly always greater in the left hand than in the right. These peculiarities are matters of common observation,

FIG. 7.



A. Skeleton of finger with lateral ligaments; 1. Metacarpal bone; 1a. Anterior fibres of lateral ligament blending with glenoid plate; 2. Metacarpal phalanx; extension checked by short anterior fibres of lateral ligament (1a) at line of metacarpal axis; 2a. Super-extension permitted when 1a long; 3 and 3a. Middle phalanx under conditions similar to 2 and 2a; 4 and 4a. Ungual phalanx.—B. Hammer finger; extension at first inter-phalangeal joint arrested by imperfect longitudinal development of anterior fibres of lateral ligament.—C. Palmar aspect of first inter-phalangeal joint (left middle finger); 1. Metacarpal phalanx; 2. Middle phalanx; 3. Anterior fibres of lateral ligament decussating with those of the opposite side; 4. Glenoid plate.

and popular expressions have ever been coined to represent the extremes in the range of variation. Thus a person who is able to bend his joints backwards to a conspicuous degree is said to be "double-jointed," and one who cannot extend them beyond the straight line is called "stiff-

jointed"; and it is well known that "double-jointedness" and "stiff-jointedness" run in families, and in some cases may be traced through several generations. In the author, for example, the metacarpo-phalangeal joints of the index and middle fingers of the right hand are "stiff," while those of the left are capable of a super-extension of 45° beyond the metacarpal axis; and precisely the same condition was present in his father, and has been transmitted to his son.

It may be of advantage to describe the articular structures of one of the finger-joints somewhat in detail. The capsule of an inter-phalangeal joint is formed on the dorsal aspect by the expansion of the extensor tendon, reinforced by the transverse fibres (the *ligamenta dorsalia* of Henle), which bind the tendon to the bone and lateral ligaments; on the palmar surface of the articulation is a glenoid plate of fibro-cartilage firmly attached to the anterior border of the distal bone, but very feebly connected with the neck of the proximal bone, and fused intimately with the anterior fibres of the lateral ligaments; lastly, at the sides of the joints are the radial and ulnar lateral ligaments, the attachment of which it is important to study closely, as they are often imperfectly described in anatomical text-books. The fibres of each lateral ligament are attached above to a little tubercle at the side of the head of the first phalanx, and from this point they radiate in a fan-like manner—the

more posterior passing to the side of the base of the second phalanx, the rest blending with the glenoid plate, and through the intermediation of this are connected with the anterior border of the base of the distal bone, decussating to some extent with fibres of the opposite ligament. (Fig. 7, c.) The strongest part of the glenoid plate, in fact, is made up of these ligamentous fibres ; and it is these which, relaxed in flexion, become progressively more and more stretched during extension, and at length by their tension bring the movement to a close, but, as already shown, the point at which the maximum tension is reached varies to a large extent in different individuals.

The physiological variations in the range of movements are thus to be explained by variations in the relative length of the anterior fibres of the lateral ligaments. The ideal constitution of a joint depends upon the existence of a certain ratio between the growth of bone and that of ligament. Should the ligaments grow in excess, their redundant length will permit great super-extension, and may even cease to check the movement ; but if the bone grow relatively faster than the ligaments, the anterior portion of the latter will the sooner become tense during extension, and where this disproportion is exceptionally great the motion may be checked before it attains physiological completeness, the result being a

"hammer finger." Irregularities of development are most likely to occur in those joints which, for one or other reason, have the least functional activity. In the hand the little finger is much less powerful than its fellows; and in association with this it may often be noticed that the fourth tendon of the flexor sublimis is reduced to a mere thread; in the foot the same thing is observed in the corresponding digit, but in a more marked degree, and it is the degenerate little toe which is most liable to the "hammer deformity."

We may then define hammer finger as the result of a developmental irregularity of the first or second interphalangeal joint (rarely of the meta-carpo-phalangeal joint) by which the anterior fibres of the lateral ligaments become prematurely tense during extension, and so check that movement before it attains its normal physiological limit. It is precisely analogous to hammer toe; but it is of less frequency than the latter affection, because while civilisation sedulously cultivates the freedom and precision of action in the fingers, it devises foot-coverings to repress the natural play of the toes. The tendency to the deformity may be transmitted by descent through an indefinite number of generations.

Diagnosis.—Spurious hammer finger, like false hammer toe, may occur from—(1) articular lesions due to rheumatism, rheumatoid arthritis, gout, tuberculosis, and inflammations of traumatic

origin ; or (2) from interference with the muscular functions by paralysis of the extensors or by spastic contraction of the flexors. In the first group the joint will be found in a more or less complete state of ankylosis, movements in all directions being impeded. In the second group the articulation, although contracted, is freely mobile under passive force, unless, as in some congenital paralyses, irregularities of development in the articulations be superadded.

Treatment.—The treatment of hammer finger is a far less simple problem than that of hammer toe, because in the toe the sacrifice of the movement of the affected articulation does not sensibly impair the utility of the digit, while in the fingers an ankylosis of the first inter-phalangeal joint in the position of either flexion or extension would be even more inconvenient than the ligamentous contraction. The measures available are (1) passive movement ; (2) subcutaneous section of lateral ligaments, with or without tendon lengthening ; and (3) amputation. In the milder cases a persevering use of passive motion will in time effect a cure ; but when the contraction has reached an advanced degree it may be impossible to make an impression by this means. We may then divide the lateral ligaments, and keep the fingers straight by means of an extension splint while the tendons are relaxed by flexion of the wrist, trusting to subsequent massage and passive motion, or, failing

this, to tendon lengthening (by a process to be described later), to overcome the resistance of the shortened muscles. Section of tendons within the theca is useless, because no uniting material is thrown out between the divided ends. As a last resource, amputation may be demanded to remove a useless and inconvenient member.

Lateral versions of the phalangeal joints.—Lateral versions of the fingers are intimately associated with hammer finger in pathology, and the two distortions are sometimes combined. The lateral inclination, which seldom exceeds 25° , may affect either of the inter-phalangeal joints, but is more frequently in the distal phalanx. Like the “hammer” deformity, it is usually found in the little finger, and is symmetrical. The version is nearly always towards the radial side, and the movements of the joint are a little impaired. Amongst eight hundred children in the Hanwell School were found six cases, of which five were double and affected the little fingers, the sixth being in the fourth digit and unilateral; in two the version was associated with slight hammer flexion. It is occasionally seen in the index finger, and the version is then towards the ulnar side. The condition is rather unbecoming than inconvenient, and cases are seldom brought to the surgeon for relief. It is a result of irregularity of development, the condyle growing a little more rapidly on one side than on the other. The con-

stancy of the radial direction of the version of the little finger is probably explained by the fact that any lateral pressure to which this digit is subjected is from the ulnar side, while in the index finger the pressure is more often from the radial side, and hence an ulnar distortion is here the more usual. The deflected joint may be straightened by the use for a few weeks of a narrow metallic side splint, jointed opposite the articulations. No operation is required.

Exaggerated forms of distortion of the fingers may occur in rheumatoid arthritis, gout, or chronic rheumatism, and in various nervous affections,¹ but these rarely call for surgical treatment.

CONTRACTIONS ARISING FROM INTERRUPTED EVOLUTION OF THE FLEXORS OF THE FINGERS, WITHOUT PARALYTIC OR SPASTIC COMPLICATIONS.

This condition necessarily belongs to the pre-adult stage of development. It is characterised by persistent flexion of one or more digits, without any articular abnormality, and unassociated with spasm or paralysis, but the contraction is of a different kind from that found in hammer finger and hammer toe. The degree of flexion varies with the position of the hand, and when the wrist

¹ See "The Hand as a Diagnostic Factor in Diseases of the Nervous System" (Long-Fox: *Med. Annual*, 1891, p. 54).

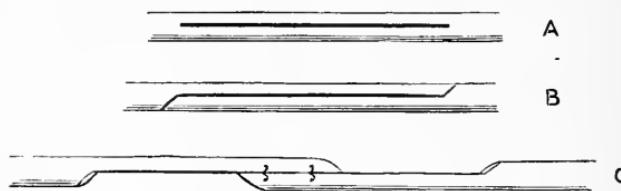
is strongly bent forwards the fingers may be extended, perhaps completely, but extension of the wrist is accompanied by a return of the contraction, the degree of which increases progressively as the wrist extension is carried nearer to its limit. The power of grasp is little impaired. Any attempt to overcome the flexion by violence is met by powerful resistance, and great pain is induced. If the patient be anaesthetised, the contraction remains unaltered, but the resistance is felt to be of a peculiar elastic character, and yields to a slight extent during the application of passive force. The defect leads to great interference with the functions of the hand. The pain caused by anything that tends to stretch the shortened muscles induces a voluntary exaggeration of the flexion, and after a time the control over the extensors is apt to become impaired. The causes are often obscure, but some examples have been traced to traumatic injuries of the flexor side of the forearm in infancy or childhood. In any case the essential factor appears to be a trophic lesion of local or central origin, which retards or arrests the due growth of a muscle or a portion of a muscle without causing its atrophy or paralysis. The following cases will serve to illustrate the phenomena so far as they have come under my own observation:

CASE 1.—M. O., a domestic servant aged seventeen, was admitted into St. Thomas's Hospital in September 1889. On

examination the third, fourth, and fifth fingers of the right hand were found to be flexed at the metacarpo-phalangeal and interphalangeal joints—the two latter strongly, the former slightly. When the wrist was fully extended the contraction became more marked, and the distal phalanges of the ring and little fingers touched the palm, but when the wrist was fully flexed the fingers could be voluntarily brought into a state of complete extension. The power of grasp was good, although somewhat less than in the left arm; the bones were normal in form and size; and the joints were quite free in their movements when the flexors were relaxed by position. The forearm muscles appeared to be of normal size. A small scar was seen about two inches below the elbow, over the inner side of the front of the arm, the result of a fall thirteen years before. The patient was strong and healthy in appearance, and showed no sign of neurotic disorder. She had never suffered from rheumatism or any other severe illness, and the family history appeared to be good. She stated that the contraction began to appear in childhood, shortly after the injury to the arm, but that it had been making more rapid progress in the past eighteen months, during which she had been growing very quickly. After a fruitless attempt to improve the condition by passive motion and splint extension, neither of which was well borne, it was determined to lengthen the tendons by operation. On October 18, 1889, the patient was chloroformed, and it was observed that the deepest anaesthesia caused no relaxation of the contraction. A semicircular incision was made over the inner side of the front of the forearm just above the wrist, the convexity overlapping the tendon of the flexor carpi ulnaris, the horns reaching to a line midway between the radial and ulnar borders of the limb. The flap of integument and fascia was reflected towards the radial side, exposing the inner portion of the flexor sublimis. The tendon of this muscle going to the ring finger was then isolated, transfixed by a fine tenotomy knife, and split longitudinally for a distance of two inches. At each end of the fissure so made the tendon was divided in such a manner as to leave one-half of the split portion attached to the proximal, the other to the distal, end of the tendon. (Fig. 8.) The tendon, a very slender

one, to the little finger was similarly treated. The effect of this measure upon the contraction was very slight. The portion of the flexor profundus common to the middle, ring, and little fingers was then drawn out and divided after the same method, and the section was followed by immediate and complete extension of the digits. When the fingers were fully straightened, the ends of the divided tendons still overlapped each other to the extent of about a third of an inch, and these portions, in each tendon, were then carefully sewn together by catgut sutures. The wound was then closed and dressed

FIG. 8.



DIAGRAMS SHOWING METHOD OF TENDON LENGTHENING.

A. Tendon split longitudinally; B. Section completed by incisions at extremities of fissure; C. Divided tendon elongated and sutured.

antiseptically (without drainage), and the hand was placed upon a plaster-of-Paris splint; the wrist and fingers being moderately flexed, in order that no undue tension should be thrown upon the united tendons. Healing took place by first intention. At the end of a week the fingers were partially extended, and four days later the extension was made complete, the alteration of position on each occasion being effected without difficulty, and at the expense of little pain. In the middle of the fourth week after the operation a feeble power of flexion had appeared. The patient was discharged on November 13, twenty-six days after the operation. Two months later the condition had much improved, and the voluntary flexion, although still weak, was almost complete as to range. All the tendons had evidently united firmly. She was directed to wear an extension splint at night, and to

practise active and passive movement at intervals in the day-time. At the end of a further three months the patient, who lived in the country, came again to London. She had been growing taller in the interval, and said that the contraction had been gradually reappearing. On inquiry it was found that she had neglected her instructions as to extension and motion. Some slight return of the flexion had appeared in the ring and little fingers, and has since been steadily increasing, till it is now almost as great as when she first attended. She has made no adequate effort to oppose the retrogression, but has almost entirely discontinued to use the affected hand. She is still, however, able to move the fingers freely at all the joints. She desires to undergo another operation; but has been advised to obey the directions given to her after the first, and to wait until her growth is quite complete before any more active surgical treatment is undertaken.

The pathology of this case is very obscure. The contraction evidently depended upon a trophic lesion, perhaps due to the injury in childhood, involving the ulnar portion of the flexor profundus, impeding the growth of the muscle, and so preventing it from keeping pace with the normal growth of the bone, but not causing paralysis. The contraction of the flexor sublimis was evidently secondary. The recurrence of the deformity may be explained by the progressively increasing length of the bones of the forearm, the muscle remaining stationary; in other words, the original cause of the condition—the incapacity of the profundus for development—persisted, and led to a return of the effect. Under these circumstances it would obviously be advisable to delay a second operation until the osseous system had reached its

permanent proportions. The operation I believe to be original ; and so far as the restoration of continuity of tendon is concerned, the result proved a complete success. It might possibly be applied with advantage in various conditions as a substitute for tenotomy.

The operation was performed independently by Professor Keen,¹ about a twelvemonth after this case, and has since been adapted to lengthening and shortening of tendons by Drs. H. A. Wilson,² Colgan,³ and Ochsner, in America.

CASE 2.—H. L., a youth aged seventeen, was admitted as an out-patient at St. Thomas's Hospital, in November 1890. He complained of a contraction of the thumb and fingers of the right hand of three years' duration. The condition began without apparent cause, and has increased progressively. He was fairly well grown, but of somewhat delicate aspect. He had an attack of rheumatic fever at the age of six, but had since been in good health. The contraction was of the same nature as that in Case 1, but less in degree, and involved all the digits. The hand was well formed, and all the bones, joints, and muscles were normal. The power of finger extension was complete during flexion of the wrist. The forearm flexors are rather small, but there is no distinct atrophy ; the movements at the wrist, elbow, and shoulder are perfect. He said that the defect crippled him greatly for work, and that forcible extension caused pain in the forearm. He was instructed to carry out a system of massage, with active and passive movements of the fingers and wrist.

¹ *Transactions of the College of Physicians*, 1895, p. 67.

² *Therapeutic Gazette*, February 15, 1892.

³ *Ibid.* October 16, 1893.

CONTRACTIONS DUE TO UNBALANCED ACTION OF
THE FLEXOR MUSCLES AFTER RUPTURE, DIVI-
SION, OR DESTRUCTION OF THE EXTENSOR
TENDON.

These accidents are not uncommon in ordinary hospital experience. The effect of such a solution of continuity over the back of the hand is to leave the first phalanx in a state of flexion, while the second and third phalanges may be voluntarily straightened without difficulty, especially if the metacarpo-phalangeal joint be passively fixed in the position of extension. The reason for this of course is that the common extensor, by virtue of its ligamenta dorsalia and its connection with the aponeurotic fibres derived from the interossei, acts with peculiar advantage upon the metacarpal phalanx, although it has no direct attachment to it, while its nominal "insertion" into the middle and ungual phalanges is subservient to the interossei and lumbricales, which are the true extensors of these bones. On the other hand, if the lesion fall just on the proximal side of the first interphalangeal joint, the first phalanx may be susceptible of almost complete voluntary extension ; but the second and third phalanges are bent by the unopposed action of the superficial and deep flexors, because the influence of the true extensors, the lumbricales and interossei, has been cut off. In

like manner, a division of the tendon over the middle phalanx leaves the terminal phalanx in the position of flexion ; and a similar result follows the accident first described by Segond, in which the extensor tendon is torn away with a portion of the bone during forcible flexion of the ungual phalanx.

Treatment.—If the injury be seen in the early stage and there is no loss of substance at the point of lesion, it may be treated satisfactorily by fixing the finger, hand, and wrist in full extension, to allow the passive approximation of the divided extremities of the tendon ; but should the case not come under notice until a later period it will be necessary to cut down and suture the tendon. If there is loss of substance and the two ends of the tendon cannot be brought together, the treatment must vary with the position of the injury. In some cases, where the metacarpal portion of the tendon is involved, a good result may be obtained by joining the distal end to the adjacent tendon so as to bring it again within the control of the muscle, but if the digital portion be the seat of the lesion this is impracticable, and a remedy may be found by lengthening the tendon, either by splitting one or both ends and suturing the extremities of the portions detached, or by transplanting a portion of a tendon from a dog into the gap. As a last resource the traction of the flexors may be balanced by an elastic extension band

replacing the destroyed tendon, and attached by one end to a little cap drawn over the finger, by the other to the dorsal aspect of a wrist gauntlet.

CONTRACTIONS ARISING FROM NUTRITIVE CHANGES
IN THE MOTOR APPARATUS.

There are at least three well-known forms of pathological change in the motor apparatus of the forearm (independent of the ordinary paralytic or spastic conditions due to nerve lesions) that may give rise to contractions of the fingers. These are —the ischaemic paralysis of Volckmann, inflammatory processes in the muscular sheaths, and gummatous formations, or more rarely other tumour growths in the muscles.

(a) The affection described by Volckmann as muscular paralysis of ischaemic origin is now seldom met with. It is a result of prolonged immobilisation of forearm fractures by any form of apparatus that intercepts the free circulation of blood through the muscles and nerves of the part. When the splint is removed the hand is found painful, dusky, and swollen, and the fingers are bent like claws, any attempt to extend them causing great pain. Volckmann believed that the nerves in these cases have preserved their power of conduction, but that the muscular fibres are structurally injured and have lost their excitability. The lesion, however, is seldom of a

permanent character, and the function may generally be restored by systematic active and passive movements, with massage, and if necessary the use of a galvanic current. Its existence is a reproach to surgery, since a careful observation of the hand and fingers during the use of splints will always give due warning of the danger.

(b) Diffuse inflammation of the inter-muscular planes and perimysial connective tissue may occur as a result of poisoned wounds, and other injuries, and may lead to a like deformity in the fingers. In a case under my own charge it was caused by a sting in the forearm by an adder. The injury was followed by the usual pain and swelling, accompanied by a painful contraction of the fingers, which lasted for nearly three months, but was ultimately relieved by the measures recommended for the ischæmic paralysis. Wounds implicating the flexors may occasionally lead to permanent contraction—either as a result of actual loss of substance, or in young subjects from interference with the development of the muscle (as in the case already mentioned). Under these circumstances the operation of tendon lengthening may be required if the endeavours to secure gradual extension are unsuccessful. König describes a case of flexion of the hand and fingers in a newly-born child, caused by a tearing of the flexors at the moment of disengagement of the arm in the course of delivery.

(c) Gummatous formations in the forearm flexors, causing painful contraction of the finger, are comparatively rare. A very interesting case of the kind is reported by Dr. A. G. Barrs in the *Medical Chronicle* for May 1891. The muscle affected was evidently the flexor profundus in its ulnar portion; and the finger contraction which bore a superficial resemblance to Dupuytren's disease, was complicated by other symptoms indicating a concomitant affection of a portion of the cord.

CONTRACTION OF THE FINGERS DEPENDENT UPON
A TENDO-VAGINITIS OF THE BURSAL SHEATH
OF THE FLEXOR TENDONS.

The following notes of an example of this somewhat rare condition under my observation may be of interest:

The patient, a girl, aged twenty, attended St. Thomas's Hospital for a swelling of the front of the right wrist, with contraction of the fingers and complete loss of use of the hand. She stated that the contraction appeared six days before without apparent cause. On examination a large swelling was found, extending upwards for about an inch and a half above the anterior annular ligament, and distally along the ulnar side of the palm as far as the root of the little finger. The phalangeal joints of all the fingers were flexed, and any attempt to straighten them caused considerable pain, while the movements of the little finger were accompanied by a peculiar coarse grating, that could be felt along the whole length of the theca and in the palm, ceasing, however, at the level of the carpus. The thumb was flexed and adducted,

and the movements of flexion and extension were painful, apparently because they led to disturbance of the enlarged bursal sheath of the finger flexors. The affection was evidently a tendo-vaginitis involving the carpal bursal sheath of the finger flexors and the palmar extension which brings this into communication with the digital bursal sheath of the little finger. The crepitation indicated that the intra-vaginal portion of the tendon was roughened by inflammatory deposits, and it is possible that these irregularities may lay the foundation for a subsequent trigger finger. The case was successfully treated by immobilisation of all the joints of the wrists and fingers in plaster of Paris, followed by passive movement as soon as the acute stage was passed.

A tendo-vaginitis of the extensors over the back of the hand may induce considerable functional impairment of the fingers, with more or less contraction at the metacarpo-phalangeal joints. Such a condition has been described by Vogt as an occasional result of gonorrhœa, and Verneuil has met it as a manifestation of syphilis. The majority of examples, however, occur without any ascertainable constitutional cause.

CONTRACTIONS DEPENDENT UPON INFLAMMATORY AND DEGENERATIVE CHANGES IN THE ARTICULAR STRUCTURES.

The deformities induced by gout, rheumatism, and rheumatoid arthritis fall more directly within the domain of the physician, while those due to tuberculous or traumatic lesions are of more immediate concern to the surgeon, but the characters

which distinguish the various conditions from each other are of interest for every practitioner. The chief points bearing upon diagnosis are as follows : In the *gouty form* the personal and family history of the patient, the acute and painful nature of the local inflammatory attacks, the presence of urate of soda deposits in the part, and the evidence of similar disease in other portions of the body. In *chronic rheumatism*, which is more often present in women and in the poorer classes, the moderately painful attacks of synovitis with crepitation, and evidence of wearing away of cartilage. In *chronic rheumatoid arthritis* the presence of bony outgrowths around the margin of the articulation is the main element of distinction from the latter condition. In *tuberculous disease* the personal and family history, the soft fusiform swelling, the tendency to breaking down of the morbid tissue, and the more or less complete destruction of the articular capsule in the later stages. Contractions with ankylosis may also occur in acute rheumatism and acute rheumatoid arthritis, and in a peculiar neuropathic condition simulating the latter. These will be referred to in connection with the contractions of the toes. In the traumatic forms the history and marks of injury will usually be sufficient for diagnosis ; but it must, of course, be understood that common injuries, by weakening the resistance of the part, may localise the attack of a specific

disease, such as tuberculosis or gout, and hence the onset of tubercular or gouty arthritis may coincide with an ordinary traumatism. It is, as a rule, only in the tuberculous and traumatic forms that the surgeon is consulted. The treatment must, of course, be based on general principles; but it is necessary to recollect that an ankylosed finger-joint nearly always renders the digit worse than useless, especially if the articulation be fixed in the position of extension.

It is only necessary to mention that contractions without joint lesion may occur in the fingers as a result of disease or injury of the bone. Simple fracture in the neighbourhood of an articulation may produce a deformity closely resembling that of dislocation. Caries or necrosis may also lead to a breach of continuity in the shaft of a bone, and various distortions may follow the cure of the disease.

CONTRACTIONS OF PARALYTIC AND SPASTIC ORIGIN FOLLOWING LOCAL INJURY.

A complete account of the various conditions falling under this denomination would require an entire course of lectures, and it is hence necessary to confine our attention to those forms which belong to the surgeon rather than to the physician.

Spastic conditions following local injury are very rare. An example was brought before the Medical

Society by Dr. Beevor¹ in April 1888, in which a contusion of the right hand in a boy of fifteen was followed five days later by permanent contraction of the hand with total anaesthesia as far as the shoulder and loss of the muscular sense, the movements of the arm and forearm remaining unimpaired. In the discussion a similar case was referred to by Dr. Hadden.

All the nerves which govern the muscles acting upon the fingers are liable to injury—the median and ulnar more particularly by wounds, usually in the wrist, and the musculo-spiral by pressure of a crutch.

An injury involving solution of continuity of the *Ulnar nerve* is a very grave accident, unless it can be treated surgically without any long delay. The symptoms are such as might be inferred from a knowledge of the distribution of the branches. It will be remembered that the nerve supplies the flexor carpi ulnaris and ulnar half of the flexor profundus digitorum in the forearm, the whole of the muscles of the hand, except the abductor, opponens, and outer head of the flexor brevis pollicis, and the two inner lumbricales, and it gives sensation to the skin over the inner side of the wrist and hand, to the palmar and dorsal surfaces of the little and ulnar half of the ring finger, and sometimes also to the radial half of the ring finger and ulnar half of the middle

¹ *Brit. Med. Journal*, 1888, vol. i. p. 961.

finger. The effects of the nerve lesion will, of course, vary with the position of the injury. If the trunk be divided just above the wrist, the branches to the two forearm muscles and the cutaneous branch to the back of the hand and fingers will be spared; but the palmar cutaneous filament will probably be implicated by the wound.

FIG. 9.



Deformity in case of wound of ulnar nerve above wrist.

The paralysis of the interossei produces an inability to flex the first phalanges and extend the second and third, while the unbalanced action of the extensor, and superficial and deep flexors, causes the position of superextension of the metacarpo-phalangeal joint with flexion of the inter-phalangeal joints, which constitutes the *main en griffe* of French pathologists (Fig. 9). The clawing is chiefly marked in the ring and little digits, especially the

latter, but is lessened in the index and middle fingers by the continued integrity of the first and second lumbricales. There is, in addition, great loss of power in flexion and adduction of the thumb, and complete loss of sensation over the front and distal part of the back of the little finger and the corresponding portion of the ulnar side of the ring finger. At a later stage nutritive changes appear in the paralysed structures, and the deformity becomes complicated by the atrophy of the skin and subcutaneous fat, the hollowing of the interosseous spaces and the wasting of the thenar and hypotenar eminences. If the nerve be injured at the elbow, the paralysis of the two forearm muscles, and the loss of sensation over the ulnar side of the back of the hand would add to the symptoms, but would not sensibly affect the deformity.

The treatment is to seek for the divided ends of the nerve, and to unite them if possible. Should the interspace be too great to allow direct suture, an attempt might be made to restore continuity by cutting a long flap from the proximal extremity of the nerve and bringing it down to the distal end; or by the transplantation of a portion of nerve from an amputated limb, or from one of the lower animals. Where the wound lies immediately above the wrist, it is well to remember that the ulnar nerve and vessels are covered by a fibrous band, which passes from the radial side of

the flexor carpi ulnaris tendon in this situation to blend with the anterior annular ligament. It should also be recollected that the deep branch of the nerve, which is occasionally implicated in penetrating wounds over the hypothenar eminence, runs around the ulnar side of the tip of the unciform process, and may there be exposed without much difficulty.¹ After operation the hand should be placed in a position of adduction and flexion, and the wound dressed antiseptically. Should this measure fail, the apparatus devised by Duchenne may be applied to replace the action of the paralysed muscles.

Musculo-spiral paralysis may be induced by ordinary wounds or contusions, by fractures of the humerus, or by long-continued compression of the nerve against the bone, either by the handle of a crutch, or while the patient is sleeping with his head resting upon an arm which is supported by the back of a chair. The consequences are paralysis of the elbow extensors, the supinator longus, the supinator brevis, and the whole of the extensors of the wrist, thumb, and fingers; and loss of sensation over the cutaneous areas supplied by the nerve in the arm, forearm, and hand. For the patient the most striking symptoms are the flexion of the wrist and fingers, the loss of power to abduct the thumb, and especially the

¹ See *Transactions of the Anatomical Society* (1892), "On the Course and Relations of the Deep Branch of the Ulnar Nerve," by W. Anderson.

enfeeblement of grasp due to the inability to fix the wrist during the action of the finger flexors. If the wrist be held firmly by the other hand, or by another person, in the position of extension, the power of grip becomes restored. A similar condition is present in lead poisoning; but here the loss of power is confined to the extensor muscles, and the supinator longus remains unaffected. The possibility of a crutch paralysis should lead the surgeon to warn every patient who is compelled to use the implement, in order that the paralysis may be prevented, or, should it occur, that it may be perceived and arrested in its earliest stages. When the condition has become established, an attempt should be made to restore function by massage and electricity, and if these fail, the nerve should be exposed at the seat of injury, and its continuity restored by the excision of the atrophic portion and union of the two free extremities.

In paralysis of the *Median nerve* by a wound above the wrist, the most distressing symptoms are referable to the trophic lesions in the integuments of the thumb, index, middle, and ring fingers (radial side) on their palmar surface and the distal half of their dorsal aspect. There is, in addition, a partial loss of power of flexion and abduction of the thumb, with wasting of the thenar eminence and some interference with the delicacy of the movements of the index and middle

fingers, owing to the paralysis of the first and second lumbricales. If the nerve be divided above the elbow, the pronators and all the flexors of the wrist, thumb, and fingers, except those supplied by the ulnar nerve (*flexor carpi ulnaris*, and ulnar half of the *flexor digitorum profundus*), are paralysed, and consequently the hand is, for all practical purposes, quite useless. The rules for treatment are similar in principle to those laid down for injuries of the musculo-spiral and ulnar nerves.

Spastic Paryses, in connection with central disease, need not be discussed ; but the surgeon is sometimes consulted for conditions of persistent spasm which apparently depend upon excessive use of certain muscles. Erichsen refers to, and figures, a case of flexion with pronation attributed to cutting with heavy shears. He notes that when the wrist was extended the fingers became flexed, and when the wrist was extended the fingers became bent in. It is not stated whether the permanency of the contraction was tested by the use of an anaesthetic, but the patient, as well as another in whom the extensors were affected in like manner, became cured by means of friction and galvanism, with the use of a straight splint. A case of spastic contraction of the right little finger of thirty-five years' duration was recently in the Mile End Infirmary. The flexion of the finger is associated with slight adduction of the hand, but the parts can be straightened com-

pletely by passive force. The condition is attributed to a wound near the elbow. There is no lesion of sensation.

The group of affections known as *Writer's cramp* usually fall within the province of the physician, and will only be briefly referred to. They are of uncertain pathology, vary considerably in their manifestations, and, although most common in persons much engaged in writing, are by no means confined to these. The symptoms may assume three different types—spastic, paralytic, and tremulous—affecting the muscles of the hands and forearm, and these may be combined in various ways. The prognosis is unfavourable; but the treatment found most hopeful is to relieve the affected muscles from the strain to which they have been accustomed, and strengthen them by massage and galvanism. Interference by surgical operation has been unsuccessful, except in one case, in which Stromeyer divided the flexor longus pollicis tendon.

CONGENITAL AND INFANTILE CONTRACTIONS.

These are usually of paralytic origin, but include a proportion of cases of true hammer finger. The common form is that already described by Mr. William Adams (Medical Society, December 1890), in which the inter-phalangeal joints of one or more fingers (most frequently the fifth) are flexed, and

the integument on the palmar aspect forms a longitudinal fold, which becomes tense when an attempt is made to straighten the digit; the metacarpo-phalangeal joint is superextended. At first the finger may be fully extended by passive force, but after a few years the position of flexion at the first inter-phalangeal joint is rendered permanent by imperfect development of the ligamentous fascial and even cutaneous structures in front of the articulation, while the terminal phalanx usually remains more or less helpless. The condition is probably dependent upon an infantile paralysis of the flexors of the affected digit. The use of friction, passive movement, and electricity, may be of value in the early stages.

TRIGGER FINGER.

The description of this curious affection has been left until the last because its true nature is still an unsolved problem, and it is hence difficult to place it in any of the groups already described. It is indeed rather a pathological curiosity than an important item in surgical disease, and many surgeons of long experience have never met with a single example. Of the mechanism of its causation we know almost nothing, of its ultimate tendencies we know little more, and its morbid anatomy is almost entirely speculative. Nevertheless, it has a literature extending over forty

years, and comprising nearly a hundred separate contributions, the last of which, a model in its way, is a monograph of 250 closely printed large octavo pages, the work of Dr. Carlier.

Trigger finger, the *doigt à ressort* of French authors, may be defined as a peculiar defect in the motions of the digit, consisting, first, of an impediment which obstructs the movement of flexion or of extension, or of both, followed, if the motive force be continued, by a sudden cessation of the resistance, and a brusque, spring-like action that often bears a remarkable resemblance to that which accompanies the opening and closure of the blade of a penknife. The first observation was that of Notta in 1850. A finger attacked by this affection generally lies when at rest in a position of flexion, and by a voluntary effort or by passive force may be straightened, with the peculiar result described in the definition, the resistance to extension suddenly yielding with a trigger- or spring-like action ; and the same phenomenon is usually but not necessarily repeated when the digit is again bent. In exceptional cases a reverse condition obtains : the passive finger is kept in a state of extension, and it is during flexion that the trigger phenomenon is elicited. The movement may be merely inconvenient, or it may be more or less painful. The sign may be constant, accompanying every movement, or it may be intermittent, disappearing and recurring without any obvious

reason. It is usually confined to a single finger, but it may be multiple. The digits most frequently involved are the middle finger, the ring finger, and the thumb, while the index and little fingers are relatively free, and the right side is more often affected than the left. It is rather more common in women than in men (in the proportion of three to two); and much more frequent in adults than in children, but may appear at all ages. The etiology is ill understood. In many cases an important influence, direct or remote, has been assigned to rheumatism; in others the condition has been attributed to injuries of various kinds; in others to occupations necessitating over-use of the digital articulations (as in sempstresses); but no cause has yet been recognised which can account for any large proportion of the examples.

Pathology.—The explanations of the peculiar movement which characterises the disease are for the most part of a purely theoretical character, for, as might be anticipated, the opportunities for direct examination of the structures have been extremely rare. It speaks highly indeed for the ingenuity of our investigators that so many plausible hypotheses have been constructed upon so small a basis of observed fact. The views now open for consideration are as follow: (1) The development of a fringe or other growth in the synovial sheath of the flexor tendons. Such a tumour lying in the synovial cul-de-sac, which

projects beyond the proximal end of the tendon sheath when the fingers are flexed, would be drawn within the theca during extension of the digit, and might in this way oppose a resistance to the movement which would be overcome as soon as the body had passed the constricted entrance of the theca. (2) A nodose condition of the tendon due to the development of a growth within the tendon or upon its synovial investment. Such a nodosity is said to have been unmistakably palpable in many cases ; but in two examples examined by Carlier, where the tactile impression of a node was remarkably strong, the tendons were found perfectly healthy at the point of examination. On the other hand, Leisering of Hamburg actually exposed a nodosity in the profundus tendon at the level of the point at which it entered the canal of the flexor sublimis, excised it, and cured the disease. In another case a fringe-like tumour was discovered springing from the synovial covering of the flexor sublimis. The nodosity accepted as a fact, the "spring" phenomenon accompanying must be explained by the varying resistance of different parts of the theca, the impediment occurring at either of the firm, resistant portions of the canal which lie at the proximal opening of the sheath and opposite the shafts of the first and second phalanges, and the sudden release occurring at the weaker points, just above the metacarpo-phalangeal joint, and in

front of the first inter-phalangeal articulation. In the case of the thumb, however, the fibrous sheath is much thinner than in the fingers, and the variations of strength in its different parts are comparatively slight after the inter-sesamoid portion of the canal is passed. An obstruction offered to a nodule in the flexor profundus by the channel in the flexor sublimis has been proposed as a cause ; but although this might be accepted for the fingers, it would not apply to the thumb, which has but one tendon within its theca. (3) An alteration in the shape of the articular surface, such as was first pointed out by König in hammer toe. In these cases the movement of the distal bone is intercepted by the presence of a ridge extending transversely across the head of the proximal bone, and when by voluntary or passive force the ligaments are made to yield sufficiently to allow the obstacle to be surmounted, the movement is terminated by a sudden spring-like action of the extensors or flexors, as the case may be. This condition undoubtedly exists in certain cases of hammer toe and hammer finger ; but it must be recollected that these two affections are developmental, and always begin during the period of active growth ; while the great majority of examples of trigger finger appear in adult life, after the osseous and ligamentous elements of the articulation have assumed their permanent form. Corresponding changes of form, however, might

occur in rheumatoid arthritis. (4) The development on the side of the head of the proximal bone of an osseous excrescence, so placed that the narrow (proximal) attachment of the lateral ligament must pass over it during the movements of flexion and extension. The possibility of this condition, suggested on theoretical grounds by Poirier, cannot be denied ; it is, in fact, normal in the tibio-tarsal joint of the ostrich ; but its existence in the human subject has yet to be demonstrated. It might well appear in connection with rheumatoid arthritis, but indications of this disease are found in only a small proportion of cases of trigger finger. (5) Spastic irregularities of muscular action. According to this view, advanced by Carlier, the muscle at fault is nearly always the flexor sublimis. It must be recollected that the flexion of the first phalanx is effected mainly by the interossei and lumbricalis, that of the second principally by the flexor sublimis, and that of the third entirely by the flexor profundus ; the extension of the first phalanx is due to the common extensor aided by the special accessory extensors in the case of the index and little fingers ; the corresponding movement of the second and third phalanges is accomplished by the interossei and lumbricales. In the thumb the metacarpo-phalangeal joint is acted upon by the long and short flexors in the one direction, and by the extensores primi et secundi internodii in the

other, while the distal phalanx is flexed by the long flexor and extended principally by the abductor and flexor brevis, which send expansions to the long flexor tendon. If, then, we assume the existence of a reflex spasm of the flexor of a joint the resistance must be overcome by vigorous action of the extensors, or by passive force ; and if under these circumstances the spasm yield suddenly the spring phenomenon might be closely simulated. The theory is ingenious, but it involves certain difficulties in its application to trigger finger in general : first, that the "spring" ought to be confined to the movement of extension, unless we assume—and this perhaps is too much to ask—that a similar spasm may affect the extensor also, and be overcome in an analogous way ; secondly, that the spring movement should be greatly altered when the tendon of the sub-limis is relaxed by flexion of the wrist and metacarpo-phalangeal joint, a modification that has not yet been recorded ; thirdly, that it should disappear during complete muscular relaxation under chloroform, and in some cases at least this has not happened,

For the present we must confess our inability to decide the question. In the majority of cases the tendon nodule hypothesis would explain the phenomenon ; and the articular theory might be tenable in adolescent cases or where there is rheumatoid arthritis ; but more direct evidence is

required and closer observation should be directed to the effect of relaxation of groups of muscle by position, and of the muscular system generally by anaesthetics.

The treatment must to some extent share in the uncertainty that attaches to the pathology. The safest and most hopeful measures appear to be a persevering use of passive movement, combined with massage. Surgical operation has been successful in two or three cases, but in others it has missed its mark and has probably left the patient in worse condition than before.

SECTION II

CONTRACTIONS OF THE TOES

THE whole of the morbid conditions described in connection with the fingers are probably represented in the toes, and the classification adopted in the former case may be applied with but slight modification to the latter.

CONTRACTIONS DEPENDENT UPON PATHOLOGICAL LESIONS IN THE CUTANEOUS AND FASCIAL STRUCTURES.

Lesions of the sole corresponding to Dupuytren's disease in the hand are extremely rare, on account of the protection afforded by the shoe and the thickness of the plantar pad, and although cases have been mentioned by Mr. Adams and other surgeons, I believe none has yet been shown or discussed at any medical society. The following example deserves record :

The patient, a gardener, aged fifty-seven, was admitted to St. Thomas's Hospital in May last with contraction of both hands. He stated that he first noticed a slight contraction

beginning in the ring finger of the left hand twelve years ago; in the course of a year or two the disease extended to the little finger, and afterwards to the middle finger. Four years since a similar affection appeared in the right hand, and shortly before admission he observed a superficial nodule on the sole of each foot. He had never suffered from gout or rheumatism, and had always enjoyed good health; the family history was negative. On examination the third, fourth, and fifth fingers were found contracted in both hands; the fourth and fifth fingers of the left hand being strongly bent at the first and second joints, and brought into contact with the palm, while on the right side the lesions were similar in character but less advanced. In each sole a flat subcutaneous nodule could be felt adherent to the plantar fascia and slightly to the integument over the head of the second metatarsal bone, but there was no puckering of the skin, and the position of the toes was quite unaffected. The contracted cords in both hands were divided by multiple subcutaneous incisions, and the fingers were extended by plaster-of-Paris splints. The nodule upon the right sole was excised, and found to consist of white fibrous tissue, longitudinally striated, and adherent to the fascia, but could be detached from it without difficulty. Under the microscope the appearances presented were identical with those in the early stage of Dupuytren's contraction, and there is no doubt that the foot nodule was pathologically the same as the contracted tissue in the hands. The operations upon the hands and feet were successful.

CONTRACTIONS DUE TO DEVELOPMENTAL IRREGULARITIES IN THE ARTICULAR STRUCTURES.

This group includes the conditions known as hammer toe, hallux flexus, and some of the lateral versions of the toes.

HAMMER TOE.

This complaint may be described as a permanent flexion from the straight line at either or both of the inter-phalangeal joints, without paralysis of muscles, unattended with any primary degenerative or inflammatory disease of the articular structures, and essentially confined in origin to the period of active growth. Some precision of definition is necessary to exclude similar deformities of wholly different pathological nature.

Hammer toe was known long before it became the subject of scientific observation. According to Dr. Cohen,¹ the first printed description was that by a French surgeon named Laforest, in a volume published in 1782, and entitled “*L’Art de Soigner les Pieds*”; but Laforest was the successor of one Rousselot, who thirteen years earlier wrote a book to which he gave the formidable name of “*La Toilette les Pieds, ou Traité de la Guérison des Cors, Verrues, et autres Affections de la Peau, et Dissertation abrégé sur le Traitement et la Guérison des Cancers.*” In this essay a flexion of the toes attributed to the use of short shoes is alluded to with sufficient clearness to make it probable that Laforest had succeeded to the ideas as well as to the practice of his predecessor. The first account, however, with any pretensions to

¹ “*Orteil en Marteau*” (Bailliére, 1888).

science, was that given by Boyer in 1822.¹ Since that time the subject has been discussed repeatedly in France, and within the last few years has been brought forward twice in England, at the Clinical Society in 1887, and at the Medical Society in 1889.

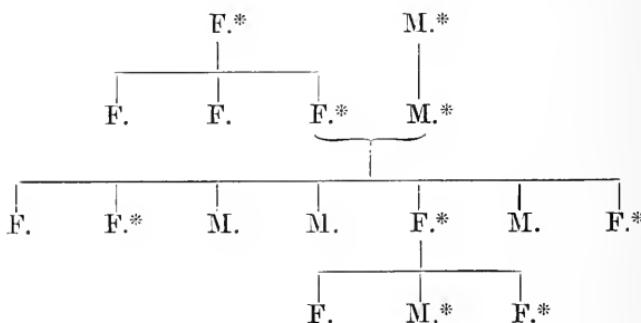
The deformity is found in both sexes, but appears to be somewhat more frequent in the male (three to two). The influence of *age* is very strongly marked. The condition invariably begins within the developmental period, and may show itself at any time between birth and adult life, but most frequently attracts the notice of the patient for the first time during the third quinquennial period. Amongst a number of incipient cases seen at Hanwell not more than one-tenth were under twelve years of age, the little toe being usually the seat of the earlier manifestations. It is said to be occasionally congenital. So far as my own observations go, neither class, occupation, nor constitutional condition, appears to have any share in its production.

It has long been a popular as well as a medical opinion that the deformity is handed down by inheritance. Even Laforest, who contests the belief, says, "Je m'entends souvent dire que l'on est né avec un doigt ainsi ; que c'est un doigt de famille." Boyer asserted that it was frequently inherited, and Blum and others have adduced examples in

¹ "Traité des Maladies Chirurgicales."

support of this view. In a paper read before the Clinical Society in 1887, I referred to a history in four cases out of twenty-two which had the same bearing; and other striking examples have since been brought forward by Mr. Adams. In fact, some evidence of the influence of the hereditary principle may be traced in at least a fourth of the examples that come under notice, and is particularly frequent and clear amongst patients of the educated classes.

The subjoined pedigree of a family in which the affection has arisen, illustrates the descent through four generations. It was noted that the



* The Asterisk indicates the members of the family who suffered from hammer toe. M. and F. signify sex.

children attacked were those who presented most resemblance in feature and temperament to the grandfather. The deformity usually appeared about the age of four, and was confined to the second toe. "Double-jointed" thumbs were also an inheritance in the family. In another example the condition developed in five children out of

eleven. Here too there was a history of "double-jointedness" in the fingers and thumb, extending through three generations; and an aunt on the male side was also the subject of hammer finger. This association of hammer toe with other developmental irregularities is significant enough to deserve attention. In addition to the instances mentioned, there are amongst the seventy-three surgical cases on my list three accompanied by hallux flexus, and one with retraction of both little toes; and there is little doubt that coincidences of a like kind would more frequently be found were it always possible to ascertain the facts by inquiry.

Seat of attack.—In surgical cases the toe most commonly affected is the second. In my list of 73 patients who had applied for treatment, this digit was affected in all but four, while the third was attacked in five, the fourth in one, and the fifth in three cases. In one instance the affection of the third toe was symmetrical, each afforded only a single example; but if all cases of contraction of the joint for 30° or more be counted without reference to symptoms, the condition is far more frequent in the little toe than in the others. Thus in an examination of a series of 800 children under sixteen years of age the little toe was found to be involved in forty-one cases, nearly all of which were double, while the second toe was affected in six only, and the third toe in five. It may be

noted also that the projection of the extremity of the second toe beyond that of the first—a condition regarded as a type by the ancient sculptors—was present in only three instances. This is confirmed by Professor Flower, who failed to find a single instance in many hundreds of children.

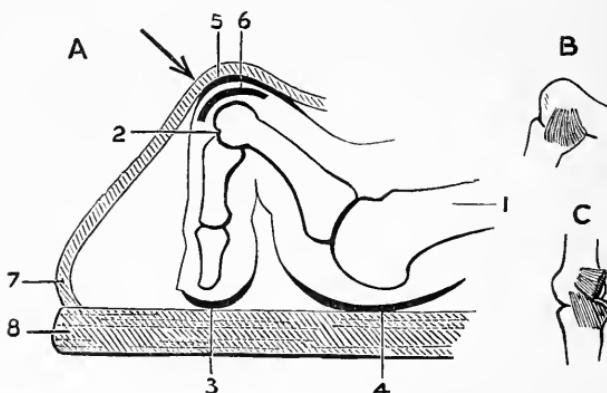
The deformity is bilateral and symmetrical in nearly a third of the cases, in the rest having a slight preference for the right side, in the proportion of five to four. It is usually localised in the first inter-phalangeal articulation, but occasionally implicates both inter-phalangeal joints, or the distal joint only.

Symptoms.—The stages of the deformity in a typical case may be described as follows: In the *first* period, which is rarely seen by the surgeon, the toe is slightly extended at the metatarsophalangeal articulation, and flexed at the proximal inter-phalangeal joint. By passive movement the flexed joint may often, but not always, be extended; but the range of motion, even in the early stage, is found to be less than that of the neighbouring or opposite toe. The distal joint is usually unaffected, and may be held straight or slightly flexed, but occasionally it undergoes contraction, either alone or in association with the proximal articulation. There is no evidence at this or any subsequent time of inflammation in or around the joint structures, except in association with corns or bursæ. How long this period may last it is difficult

to say, as it may altogether escape the notice of the patient. In the *second* stage the flexion of the inter-phalangeal joint becomes more pronounced, and the secondary extension at the metatarso-phalangeal joint increases *pari passu*. At this period the affected articulation is fixed for all movement of extension, but the power of flexion within the limits left to it remains unimpaired ; in other words, the angle may be diminished, but not widened, and the toe, although contracted, is neither ankylosed nor paralysed. In exceptional instances the flexion may be overcome by strong passive force, and a distinct trigger-like action established, the middle phalanx becoming extended and flexed again with a movement very comparable to that which takes place during the opening and shutting of the blade of a pocket-knife. As secondary results of the contraction of the proximal inter-phalangeal joint the patient is subject to certain inconveniences which may give rise to much suffering, and are usually the immediate cause of his appeal to the surgeon. The chief of these are a bursal formation, which is very liable to inflammation, over the angle of flexion, and two associated callosities, one above the head of the retracted phalanx, the other beneath the head of the metatarsal bone, both consequent upon the pressure exercised by the boot. (See Fig. 10.) A third callosity may develop over the tip of the toe, and the soft parts over the

terminal joint may become somewhat swollen, so that the digit presents a clubbed appearance. The degree of interference with functions and comfort varies greatly in different cases, partly in relation to the degree of the contraction and partly to the sensibility of the patient. In some persons a

FIG. 10.



A. Diagram showing position of bones in hammer toe, involving the proximal joint; 1. Metatarsal bone; 2. Head of first phalanx; slight groove corresponding to position of dorsal border of base of second phalanx; 3, 4, and 5. Callosities due to boot pressure; 6. Bursa over contracted joint; 7, 8. Shoe. The arrow indicates the direction in which the pressure of the upper leather tends to force downwards the head of the metatarsal bone towards the sole. B. Dissection of first inter-phalangeal joint in hammer toe; C. The same preparation after section of plantar fibres of lateral ligaments.

hammer toe of a marked kind will cause so little trouble that no medical advice is sought—this is especially the case when the contraction is limited to the little toe; in others the suffering is so great that the patient begs the surgeon to remove the offending member with the knife, and remains absolutely crippled until an operation is practised

for his relief. When the deformity affects more than a single digit, an interval varying from a few months to five or six years may elapse before the second attack appears. As a rule, it is the corresponding toe on the opposite foot that suffers, but occasionally a neighbour is selected ; or even the distal joint of the same or another toe.

Morbid anatomy and pathology.—The earlier opinions upon the pathology of hammer toe were very conflicting. Gosselin, who dissected a specimen, was unable to find any lesion. Fano, in 1855, mentions as the chief defect a cartilaginous nucleus in the extensor tendon. Blum described a luxation of the first phalangeal joint, with a thickening of the whole capsule, and maintained that the contraction of the toe was due to a periarthritis set up by the inflammation resulting from corns—a curious example of “*hysteron proteron*.” Blandin attributed the affection to a shortening of the plantar fascia ; Boyer to a retraction of the extensor tendons ; Roche and Sanson to a contraction of the flexor tendons, and other surgeons to a paralysis of the interossei, but no attempt was made to separate true hammer toe from the arthritic and traumatic deformities which simulate it. It is now beyond doubt that the essential seat of the contraction is in the joint itself. The specimen represented in B, C, Fig. 10, is one prepared by myself in 1882 from a toe which had been amputated by a colleague. It showed that the deformity

was not affected by section of the tendons, but that it yielded immediately upon division of the plantar fibres of the lateral ligaments where they blended with the glenoid plate. This observation, which has been confirmed by a dissection of Mr. Walsham's, was not published until 1887, and it was by Mr. Shattock, who, working independently, had found the same lesion, that the condition was first made known at the Clinical Society in the same year. The preparation illustrating his paper is now in the museum of St. Thomas's Hospital, as well as a second dissection demonstrating the absence of disease in the interossei. The results of these and later investigations may now be stated.

- (1) There are no essential alterations of muscle or tendon except those secondary to the contraction of the joint—namely, an undue tension and prominence of the extensor tendon over the metatarsophalangeal articulation, and an adaptive deficiency of length in the flexors, which are prevented by the permanently bent state of the articulation from keeping pace in growth with the osseous structures.
- (2) The skin and fasciæ in like manner are unaffected or only undergo a secondary shortening on the flexor side in severe and long-standing cases.
- (3) The articular surfaces generally show no change beyond atrophy of that portion of the cartilage of the head of the proximal bone, which is permanently excluded from contact with

the distal bone in consequence of the imperfect range of extension of the joint. In some cases, however, a distinct transverse groove is present on the head of the proximal phalanx at the point where it comes in contact with the dorsal border of the base of the distal bone during the attempt at extension, and behind this groove the bone may be heaped up into a little ridge. It is the existence of this irregularity that explains the trigger phenomenon previously alluded to. (4) The ligaments present no structural change, but an important quantitative defect is always found in the plantar fibres of the lateral ligaments, which are so short that they check prematurely the movement of extension of the joint.

The real origin of the articular defect has been the source of much argument. At all times, whatever may have been the opinion as to the exact morbid anatomy of the condition, there has been a strong disposition to blame the shoemaker, or rather the fashion that dictated the arbitrary form the shoe was to assume, as the prime cause of the disease. There is, of course, no question that the mistaken ideal of elegance which finds expression in the demand for tight and pointed boots has been the cause of much misery and deformity, and it appears only natural to assume that the artificial crowding together of the toes might force one of the members to assume a position of retraction, in order to make room for the

rest, and the digit so drawn up might after a time become permanently fixed in its abnormal attitude. This view is well expressed by Mr. Ellis,¹ but the study of a number of cases of hammer toe furnishes strong reason for doubting this fatally plausible hypothesis. The deformity may be seen in early infancy, before any rigid foot covering has been adopted ; and a precisely analogous condition is known to exist in the fingers, which are not subjected to any artificial restraints. Moreover, in the great majority of the feet affected with hammer toe there is a complete freedom from the deformities which are known to result from overcrowding of the digits, and there is seldom anything in the history of the cases to indicate the past use of improper boots.

It has been said that hammer toe is unknown in countries where boots are not worn ; but the subject has yet to be studied in those parts of the world on a scale that sanctions generalisation. Moreover, as hammer toe is painful only in consequence of the friction and pressure induced by the foot-covering, its existence would be unlikely to attract much attention in a bootless race. During my own residence of six years in Japan I never met with an example, and my friend Surgeon-General Takaki writes to me that his observations, covering a period of fifteen years, are equally negative ; but it must be noted that it is

¹ "The Human Foot," 1889.

the rising and boot-wearing generation that has been especially brought under our notice, and the conclusions to be drawn from our experience tend as much to contradict the view that boots are an immediate cause of hammer toe, as to support the belief that the Japanese are exempt from the defect. There is little doubt, however, that the use of shoes is to some extent, and in a remote sense, a predisponent to this and to other analogous deformities, for it is certain that a rigid leather foot-covering, even when shaped according to the most scientific principles, must necessarily impede the free action of the toes, and so interfere with the processes of nutrition and development ; but I am equally confident that few, if any, of the examples of hammer toe that have come within my own experience could be traced to any special defect in the form of the shoe. Out of the whole number only six confessed to having worn tight boots. In the rest, neither history nor inspection indicated any fault of the kind, and the feet in the great majority were perfectly well formed in all other respects, and bore no marks of injurious compression. In a case of inherited hammer toe in which the proximal joint of the second digit of the right foot was straightened by operation, the boots worn before and after the operation were made upon sound anatomical principles ; but nevertheless the patient came two years later with a contraction of the distal joint of the same

toe and of the middle toe of the opposite foot, and a lateral distortion of the fourth toe.

The pathological explanation I believe to be that advanced to account for the occurrence of hammer finger. The examination of a large number of healthy feet will reveal physiological variations in the condition of the inter-phalangeal joints exactly comparable with those noted in the hands. The second phalanx may in some persons be super-extended 30° beyond the axial line of the proximal bone, while in other instances the movement is arrested by tension of the plantar fibres of the lateral ligaments before this line has been attained;¹ and in the distal joint even greater variation may be found. There is, in fact, a physiological tendency to hammer toe in large numbers of people who never actually suffer any inconvenience from it, and it is in the exaggeration of this physiological irregularity that we have to seek the pathology of the surgical hammer toe.

¹ It is unnecessary to enter minutely into the conformation of the inter-phalangeal joints, but it must be understood that the proximal attachment of the plantar fibres of the lateral ligaments lies at a point below the centre of the dorsal half of the condylar curve, and hence these fibres become more and more stretched as their distal attachment is carried upwards in the direction of extension, until at last the motion is checked by their tension. The point at which the arrest occurs necessarily depends upon the relation existing between the length of the fibres and that of the radii of the condylar curve. If the ligaments of a joint be artificially elongated by acrobatic training in early life, they may lose their power of fixing the range of movement, and extension may then go on until it is stopped by contact of bones or by contraction of opposing muscles. The latter factor, of course, is always an important one, but it does not affect the present aspect of the question.

The tendency ceases at adult life, because the ligamentous and bony structures of the articulation have then assumed their permanent condition, and any later deformity simulating it can only occur as a result of a totally different set of conditions.

Hammer toe, then, like hammer finger, must be regarded as the result of inadequate longitudinal evolution of the ligaments which limit the movement of extension at the inter-phalangeal joints, and the symptoms induced by the deformity are mainly dependent upon the formation of callosities and bursæ by contact with the opposed hard surfaces of the foot covering. This irregularity of development may be either inherited or accidental.

Treatment.—It is probably not within our power to prevent the occurrence of hammer toe, even by the greatest care in the selection of boots. For its relief when developed many plans have been adopted, the chief of which are as follow :

1. Extension by splints of various kinds in the early stages, while the contraction may be overcome by passive force. The condition is rarely seen by the surgeon in this period, but should it fall under observation the persevering use of passive extension is preferable. When the deformity is well marked, splints are painful and useless.

2. Tenotomy of the extensor tendon (Boyer). This measure, which was doubtless suggested by

the visible tension of the tendon in many cases, is more likely to aggravate than to relieve the symptoms.

3. Tenotomy of the flexor tendons. This to be successful must involve also the section of the glenoid and lateral ligaments. Such an operation has been practised both by the subcutaneous and by the open methods, but it involves the risk of division of the plantar digital nerves, and the necessity for a prolonged after-treatment to prevent recurrence. It has even been advised by Petersen to treat the contraction by a transverse incision, through integuments, tendons, and ligaments, down to the articulation, but the promptitude of the method is its sole recommendation.

4. Subcutaneous division of the lateral ligaments has been performed with good results by Mr. Adams, but it has the disadvantage of requiring a long after-treatment.

5. Resection of the joint. This is unquestionably the most eligible measure, and has been successfully practised on different plans by various surgeons during the last twelve years or more, both in England and France. The articular extremities of both bones may be removed or the head of the proximal bone only, the distal bone being left intact. In either case the toe is subsequently fixed for a period of three or four weeks in an extended position. The procedure I have found most speedy and satisfactory is as follows: An

incision is made on the lateral aspect of the affected articulation, following the axis of the bones and exposing the lateral ligament, while leaving intact the vascular and nervous trunks. The ligament is then divided, by a touch of the knife, and by a forcible lateral movement the head of the proximal phalanx is made to protrude through the wound, and is removed with a pair of bone nippers. The toe is straightened, the wound closed by sutures (without drainage), and dressed. Antiseptic precautions must be strictly observed, and the operation must not be performed until all inflammatory signs have been removed from the superjacent corn. The operation can be completed within two or three minutes, and, what is a far more important consideration, it involves the least possible interference with the structures of the toe. The wound heals by first intention, and after a fortnight's rest the patient is able to walk, the toe being extended for a few weeks upon a dorsal splint of flat steel, such as was used in making the now obsolete appendages to the back of the feminine skirt. The result is all that could be desired, and the relief immediate and permanent. The same operation is applicable for the distal joint, but is less easy.

6. Amputation was, until within the last ten or twelve years, the usual resource after the failure of tenotomy of the extensor. It affords a curious comment upon the surgery of the pre-antiseptic

period that the chief reason given against this operation by the early writers was its danger to life. At the present time it can rarely be needed unless, by any accident, the antisepsis of the resection operation fails and acute inflammation sets in. The objections to it are the mutilation, and the tendency to lateral distortion of the adjacent toes to fill the gap left by the lost member.

HALLUX FLEXUS.

Hallux flexus appears to have been first recognised as a separate affection only a few years ago, in 1887, and it is to Mr. Davies-Colley that we are indebted for the name and for the earliest discussion of the characters and causation of the disease. It is stated, however, by Blum that Nélaton described a “cou de cygne” of the great toe, and attributed it to the use of short boots. I have been unable to discover the reference in the works of this surgeon, but if the citation can be verified, the credit of recognising the existence and nature of the deformity will fall to him, for there is no doubt that hallux flexus is pathologically a “cou de cygne” or hammer toe. Since Mr. Davies-Colley’s introduction of the subject various contributions have been made, by Mr. Howard Marsh, Mr. Reginald Lucy, Mr. Cotterell, Mr. Ellis, and others, and I must draw especial attention to a valuable analysis of thirteen cases

by my colleague, Mr. Makins, in the St. Thomas's Hospital Reports for 1888. The complaint is by no means a rare one, for since 1887, when I began to take notes of all the cases that were brought under my observation in private and hospital practice, I have accumulated a list of thirty examples of what may be termed true "hallux flexus," besides a number of contractions presenting a superficial resemblance to it, but resulting from arthritic lesions. I propose, as in the case of hammer toe, to separate these latter entirely from the former, because the pathological, and even the clinical, distinctions between the two classes are perfectly well marked, and it hence can only mislead to place them in the same category.

Hallux flexus may be defined as a progressive diminution of the normal range of extension at the metatarso-phalangeal, or, more rarely, at the inter-phalangeal joint of the great toe. It is unassociated with any disease of the bones, cartilages, or synovial membrane of the articulation, and originates only during the period of active growth. It is, in fact, a "hammer great toe," and it will be found strictly analogous to the disease just described, occurring under the same conditions and affecting the corresponding articulations.¹ The name proposed by Mr. Davies-

¹ It must be recollected that morphologically the metatarso-phalangeal joint of the great toe corresponds to the first inter-phalangeal joint of the smaller digits.

Colley has been objected to on more grounds than one. In the first place, there is perhaps a lack of soundness in the pedigree of the word "hallux." It is a rather modern addition to anatomical nomenclature, and its sanction in classical literature is very dubious. In Plautus there is an expression "hallex viri," implying a little man, a "thumbling," and the words "hallex," "allex," and "hallux" have been used by other writers with a somewhat questionable signification for the great toe. A purist might indeed be justified in opposing the adoption of either "hallex" or "hallux," and especially the latter; but the convenience attached to a distinctive name for the great toe in place of that of "pollex," which is applied also to the thumb, is so great that we are not tempted to be hypercritical on philological grounds. A more serious objection has been raised against the adjective "flexus," because in the majority of cases the toe is not actually in the position of flexion; but the term "flexion" may be applied in the sense of movement as well as in that of position; and although the great toe in hallux flexus may not reach the position of flexion, it has passed through the motion of flexion before it has attained the line of direction in which it is found in the disease.

Symptoms.—In a typical case of hallux flexus the patient, usually a boy near the age of puberty, suffers some little pain about the metatarsos-

phalangeal articulation of the great toe in walking, at the moment when the weight of the body falls chiefly upon this joint. Rest affords complete relief, and the structures about the articulation show no signs of inflammation. As time goes on the pain increases and becomes associated with a sense of rigidity of the toe, and the power of full extension becomes lost. The diminution of the range of movement is very gradual, and usually it is not until the proximal phalanx can no longer be extended beyond a line corresponding to the prolonged axis of the metatarsal bone that the condition is brought before the surgeon, but in more extreme examples the toe becomes actually bent below this axis, so that it forms with the metatarsal bone an obtuse angle with plantar opening. The foot is now seriously crippled. Over-use in walking induces much suffering, and any attempt at passive extension is extremely painful, while flexion still remains unimpaired. The head of the metatarsal bone thrown into prominence by the unwonted position of the proximal phalanx looks abnormally large. In some cases a reflex hyperæmia of the tissues surrounding the joint may be induced by forced exercise ; but there is rarely, if ever, any effusion within the capsule. The patient finds walking more and more difficult, and to avoid pressure upon the contracted articulation limps on the outer edge of the foot ; but this gives little relief,

and at last he is compelled to rest. In the more severe cases the patient consults the surgeon; in the slighter forms he puts up with the inconvenience, and we may assume that he recovers without professional assistance, for the condition is very seldom found after the attainment of full adult life.

An analysis of my series of thirty cases shows that the deformity is much more frequent in boys the number including only three girls. (In the series of thirteen cases recorded by Mr. Makins the proportion of males to females was eleven to two). It was bilateral in one case only, right-sided in nineteen cases, left in ten, and affected the metatarso-phalangeal articulation in every instance, except two in which the distal joint was involved. (Fig. 11.) In only three cases did the flexion pass the prolonged axis of the metatarsal bone, the angle reached in the worst example being 150° ; in the rest the toe during full extension was either in a line with the metatarsal bone, or formed with the latter a very obtuse angle, 170° to 160° , with the opening towards the dorsal aspect. The ages at which the symptoms were first noticed ranged from twelve to eighteen, in the greater number lying between fourteen and sixteen. The associated deformities were: excessive length of toe in two cases, this amounting to a distinct giant growth in one, hammer toe (second) in one, hallux valgus (slight) in three, flat-foot in four, and slight varus

in one. In the other cases the feet were perfectly normal in shape. The duration of the disease before the patient came under treatment varied from three months to four years. Occupation appeared to exercise little influence; the subjects

FIG. II.



Hallux flexus of the distal joint.

were mostly schoolboys, labourers, and errand boys, but there was no reason to believe that there had been any unusual strain upon the powers of endurance, except in two instances. In two cases the condition was attributed to the use of short boots, but in the others no complaint was made as to the foot covering, and that in wear at

the time of attendance was as unobjectionable as the materials and plan of the modern boot will allow. Constitutionally, the patients were, for the most part, a little below the average in physique ; one (a girl) was tuberculous, and one was a child of rheumatic parents, but none had suffered from rheumatism. The result of inquiries with respect to inherited tendencies was less striking than in the case of hammer toe. In one instance the father had double hammer toe, in another a brother had suffered from hallux flexus at the age of sixteen, and became cured without medical intervention in the course of three years ; but in the majority no satisfactory information on the point could be obtained.

Progress.—There can be little doubt that the natural tendency of the complaint is to subside under the mechanical influence of ordinary exercise, and hence, although the deformity is fairly common in youth, it is rarely found in fully developed adults, except where the distal joint is affected. In one case of this kind the contraction began about puberty, and was still present at the age of fifty-two, but the defect never interfered materially with locomotion. It is possible that some of the ordinary cases terminate, as suggested by Mr. Davies-Colley, by conversion into hallux valgus, but my inquiries have failed to confirm this.

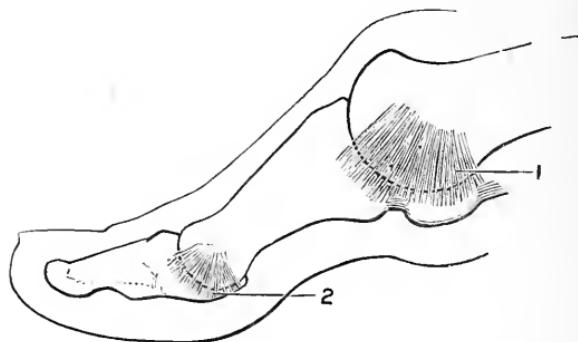
Pathology.—The origin of the condition may be

explained in the same manner as that of hammer finger and hammer toe. There is a physiological variation in the range of movement permitted in the articulations of the great toe similar to that demonstrated in the fingers and lesser toes, and in examining a number of healthy feet it will be found that the position of extreme super-extension at the metatarso-phalangeal joint may lie at any point between 30° and 110° beyond the prolonged axis of the metatarsal bone ; but if the movement of extension be checked at less than 30° , the symptoms of hallux flexus supervene. The chief distinctive feature in the anatomy of the joint lies in the substitution of two sesamoid bones, with their tendons and connecting tissue, for the glenoid plate developed in all the other articulations, and it is those structures that receive the distal attachment of the plantar fibres of the lateral ligaments. (Figs. 12 and 13.) The function of the lateral ligaments, however, remains the same as in the other toes, and the range of the movement of extension is governed by the development of their plantar fibres.

The opportunities of examining the morbid anatomy of the complaint are necessarily very few. Mr. Davies-Colley's specimen proves that the structures restraining the movement of extension correspond to those concerned in the production of hammer toe, those fibres of the lateral ligaments which blend with the osseo-tendinous

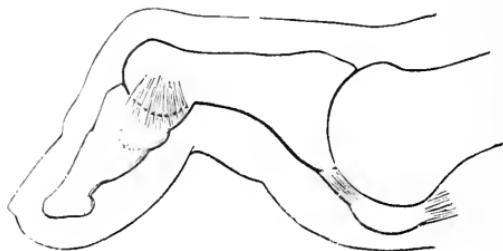
structures replacing the glenoid plate; and the cause of the deformity in both cases appears to be an irregularity of nutrition by which the liga-

FIG. 12.



Bones and ligaments in hallux flexus. 1. Lateral ligament of metatarso-phalangeal joint; inferior fibres attached to sesamoid bone; 2. Lateral ligament of inter-phalangeal joint; inferior fibres blending with glenoid plate.

FIG. 13.



Hallux flexus of the distal joint.

mentous fibres undergo imperfect longitudinal development, and consequently induce premature arrest of the movement of extension. This developmental defect is probably unconnected with any special error in the form of the shoe.

Like hammer toe, the deformity occurs at the age most prone to nutritive disturbance; but hallux flexus tends to undergo cure without the help of the surgeon, because the weight of the body serves as an extending force, which sooner or later proves stronger than the resistance opposed; while in hammer toe the lesser digit is not essential to locomotion, and its retraction at the metatarso-phalangeal joint frees the interphalangeal joint from all necessity for action, and favours the permanency of the vicious position.

Hallux flexus of the distal joint must be distinguished from the paralytic hallux retractus which simulates it (see p. 127).

Treatment.—Bearing in mind the fact that true hallux flexus has a natural tendency to recovery, it is obvious that the graver surgical operations can seldom be called for. In the case of hammer toe a resection of the articulation may be undertaken without hesitation, because the deformity is more likely to become aggravated than relieved by lapse of time, and because the function of the digit is not sensibly interfered with by obliteration of the joint; but the destruction of the metatarso-phalangeal joint of the great toe entails a permanent alteration of gait. The treatment I have adopted in the milder cases is to instruct the patient to perform a regulated series of passive movements of the toe by the use of his hands, aiding the process by massage of the lower and

inner side of the foot, and as the tenderness passes away to practise walking on tiptoe until the normal degree of extension is restored. In more severe examples I have extended the joint forcibly under an anæsthetic, afterwards fixing it in the super-extended position in a plaster splint for three weeks. The result of this plan has been so satisfactory that I have found it unnecessary to do more, but should it fail, we have the choice of several plans: (1) Section of the lateral ligaments, subcutaneously or by means of an open wound. (2) Excision of the head of the metatarsal bone, an operation necessarily involving obliteration of the joint and a shifting of the point of support to the distal joint, which is less well fitted to discharge the office. It might, however, be permissible in certain cases. (3) Excision of the proximal half of the first phalanx. This has been successfully effected by Mr. Davies-Colley. (4) Osteotomy of the metatarsal bone above the head, with excision of a dorsal wedge proportioned to allow the toe to be placed in a position of slight super-extension, the articulation being preserved intact.

It is improbable that any of these more severe measures will be required if the method of forcible reposition be well carried out.

HALLUX VALGUS.

This, the most common of all digital deformities, may be defined as an eversion of the great toe at the metatarso-phalangeal joint, and in some instances of the phalangeal joint also, with alterations, adaptive or causative, in the bony and ligamentous apparatus of the articulation. It is often accompanied by deformities of the other toes and by flat foot. In its milder forms it must be regarded as a simple malposition caused by the use of boots constructed on the principle of median symmetry ; and as this fault is more common in the shoes made for women than in those worn by men, the distortion is far more frequent in the latter sex. In a large number of patients examined by Dr. Robinson and myself in the female wards of the Mile End Infirmary, over ten per cent. were found to be affected in greater or less degree ; while in the male wards the proportion did not exceed three per cent. It is a noteworthy fact that the deformity is comparatively rare in the period before puberty. I was able to find only three examples, and these of a very slight kind, among 800 children under the age of sixteen ; while incipient hammer toes and hammer fingers were present in considerable numbers. This early immunity is probably due to the fact that the vanity which leads the adolescent to sacrifice

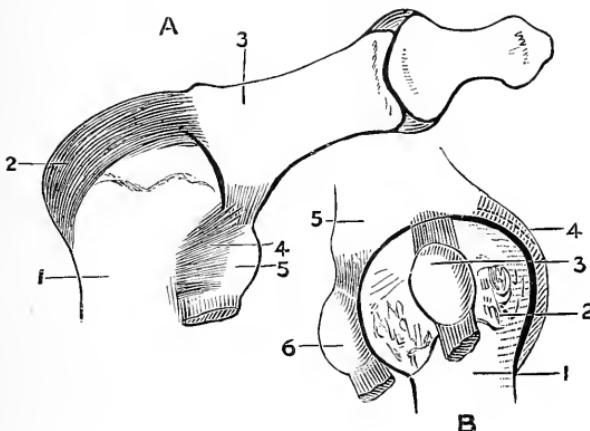
comfort to a false elegance has not awakened in the child. The more severe cases of hallux valgus in which the toe is so far everted as to form an angle of from 120° to 90° with the metatarsal bone are comparatively rare, the total number amongst 2600 persons amounting to no more than thirty (twelve male and eighteen female). It is with these that we are especially concerned, and it is probable that they are closely related in origin to hallux flexus.

Morbid anatomy.—On examining a well-marked hallux valgus it is seen that the faceted surface of the head of the metatarsal bone has been extended considerably over the external aspect, the prominent inner side of the head lies beneath the stretched joint capsule, the sesamoid bones are displaced outwards from their normal grooves, the internal lateral ligament is greatly elongated and considerably thickened, the external ligament undergoes an inversely proportionate shortening and opposes the reposition of the displaced phalanx (Fig. 14); and the cartilage over the portion of the joint surface, removed from its normal contact with the opposed bones, presents marked degenerative changes. The integumentary structures over the projecting head of the metatarsal bone are affected in the same way as those over the angle of flexion in hammer toe, as a consequence of friction by contact with the shoe leather; callosities and bursal formations, often of great size, are

found, and inflammation of the abnormal bursa may give rise to great suffering.

Although the great majority of cases of hallux valgus are undoubtedly provoked by ill-shaped boots, it is probable that some, and especially

FIG. 14.



Hallux valgus. From a preparation at St. Thomas's Hospital.

A. *Dorsal aspect.*—1. Metatarsal bone; 2. Elongated and thickened internal lateral ligament, a large bursa lay over this; 3. First phalanx; 4. Shortened external lateral ligament; 5. Displaced external sesamoid bone.

B. *Plantar aspect.*—1. Metatarsal bone; 2. Degenerating cartilage over disused sesamoid furrow; 3. Displaced internal sesamoid bone; 4. Section of thickened capsule (the structure had here assumed the character of a glenoid ligament); 5. First phalanx; 6. Displaced external sesamoid bone.

those of a very aggravated type, are, like hallux flexus and hammer toe, dependent essentially upon causes not obviously connected with any vice in the foot covering. It is at least certain that some examples of extreme deformity are confined to one foot, the opposite member being

of normal shape—a fact that strongly negatives the boot theory ; and there are also bilateral cases in which the form of the distortion and the history given by the patients and friends make it equally difficult to accept the common explanation. In one instance recently under my notice the first, second, and third toes of the left foot were carried outwards over the fourth, producing a deformity of a strongly marked kind, while the right foot was perfectly well formed, and the patient, an intelligent woman, insisted that “the toes went wrong by themselves while she was growing up,” and that her shoes had nothing to do with it. In some cases the conditions may be traced to paralytic or spastic affections, and if we accept the developmental theory with respect to hammer toe and hallux flexus, we may assume that hallux valgus occasionally arises in the same way.

Treatment.—Hallux valgus, like hammer toe, is often rather a question of æsthetics than of pain or inconvenience, and the patients are only moved to see the surgeon by a natural desire to get rid of a deformity ; but in many cases the inflammatory complications occurring in connection with the associated “bunion,” or the interference with the neighbouring toes, upon whose territory the larger digit is encroaching, may give rise to actual and even intolerable suffering. In the milder examples the use of a well-shaped boot, and a stocking made with a separate pocket for the great toe, as recom-

mended by Mr. Ellis, will be sufficient to allow the rectification of the defect, and to these elementary measures may be superadded Bigg's bunion spring, which can be obtained from most instrument makers, or a vertical septum may be introduced into the boot in the normal position of the cleft between the first and second toes. In the more severe cases these plans of treatment are insufficient, and we then have the choice of several alternatives.

1. Section of the neck of the metatarsal bone with excision of a cuneiform segment from the tibial side has been performed successfully by Mr. A. E. Barker.¹ This allows the articulation, together with the entire toe, to be restored to the straight line, but the abnormal disposition of the articular surfaces and ligaments remains uncorrected, and there is reason to fear that trouble would arise later.

2. Forceable rectification under an anaesthetic is satisfactory for slighter cases. It may be aided if necessary by subcutaneous section of the opposing tendinous and ligamentous structures on the tibular side, and the toe is fixed for two or three weeks in plaster of Paris. The rectification should be preserved by the use of properly constructed shoes with a septum between the first and second toes, when the patient begins to walk.

3. Resection of the joint is undoubtedly the

¹ *Lancet*, 1885, vol. i.

best operation in the more severe operations of hallux valgus. Involving the obliteration of an important articulation, it was feared that it might induce serious crippling, but the plan has been adopted with perfect success by Mr. Clutton¹ who, excising the cartilaginous extremities of the bones and fixing the shafts in suitable position by means of an ivory peg, has secured the best results. During the last two years I have applied the principle of the operation recommended for hammer toe. Excision of the head of the metatarsal bone is performed through a longitudinal incision over the inner side of the joint, the toe is then replaced and fixed for three weeks in a slightly extended position by means of plaster of Paris. The success of these measures is far more complete than could have been anticipated on theoretical grounds. The distal joint appears to replace almost perfectly that which is lost, and the locomotion is easy and unfatiguing. In a case of my own the patient was able to walk twenty miles a day within three months of the operation.

HALLUX VARUS.

The following is a curious example of this rare condition, in association with macrodactyly. The patient, a boy aged eleven, was admitted

¹ *St. Thomas's Hospital Reports*, vol. xxii. (1893).

into St. Thomas's Hospital in March 1887, with a deformity of the right great toe, dating from infancy. The member was somewhat imperfectly developed, and projected inwards almost at right angles with the metatarsal bone. (See Fig. 15, A.) A slightly prominent integumental fold was present on the inner side of the metatarso-phalangeal

FIG. 15.



Hallux varus. A. Before operation; B. Three years after operation. The relatively small size of the great toe in B is due to the abnormally great development of the other toes (not represented in Fig. A).

joint, and the ligamentous and other fibrous tissues beneath this resisted the replacement of the digit in its normal line. The toe could be moved feebly by an effort of the will, but the abnormal direction of the member prevented the muscles from exercising any useful function. The smaller toes were distinctly hypertrophied, but were otherwise well formed. The boy was unable to wear a boot, and was completely crippled. The

toe was apparently useless, but it was judged advisable to restore it to its natural position rather than to amputate. This was effected by subcutaneous division of the internal lateral ligament and the application of a small plaster apparatus. Fifteen days later the child left the hospital with a light metal splint fixed to the inner side of the foot and toe. Three years afterwards he presented himself for examination, and it was found that the good result was more than maintained, as the toe was not only straight, but had acquired its normal size and considerable power of movement. The boy said he was able to walk seven or eight miles without fatigue. The relative hypertrophy of the lesser toes was still obvious.

LATERAL DEVIATION OF THE LESSER TOES.

This is frequent in childhood. It was found in twenty-five children, twelve males and thirteen females, out of 800, the ages of the subjects ranging between five and fourteen. The version is usually at the first inter-phalangeal joint, but may also be present in the distal joint, and the toe much more frequently diverges towards the tibial than towards the fibular side (six to one). It may lie over or under its neighbour. The fourth toe is affected in about two-thirds of the cases, while the second, third, and fifth toes take an almost equal share in

making up the remaining third. It is symmetrical in nearly two-thirds of the examples (sixteen out of twenty-five). In the early stage the joint may be straightened by passive force; but in the later, reposition is opposed by ligamentous tension, and perhaps by some alteration in the form of the bone. Like hammer toe, it occurs only during the developmental period, and there is no reason to connect it with any special defect in the shape of the shoe. In none of the examples under my own observation was it associated with hallux valgus; but a double hammer toe (third) was present in one case, and version of the fingers in three others. The children appeared to be in good health. The deformity may usually be relieved by the use of a splint, like that recommended for hammer toe; but in some cases a partial resection might be advisable.

Inversion of the little toe at the metatarso-phalangeal joint is occasionally met with. It appears always to arise during the period of active growth and is associated with shortening of the extensor tendon. Subcutaneous section of the tendon allows complete reposition, and the cure may be made permanent by temporary fixation in plaster, and subsequent attention to the feet. The origin of the condition is obscure.

ARTHRITIC DEFORMITIES OF THE TOES.

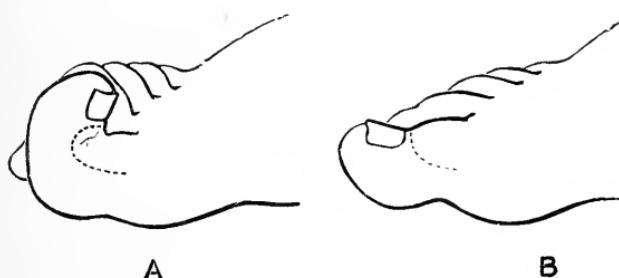
Arthritic hammer toe may be due to rheumatoid arthritis, gout, rheumatism, or traumatic inflammation. The variety dependent upon rheumatoid arthritis is the most common of these, and the most likely to be brought under the eye of the surgeon. Its characteristics are as follows : 1. It is not limited to the developmental period, and may occur at any age in association with the causative disease, but it is most frequently met with after middle life. 2. The deformity is usually present in many or all of the toes and in both feet, and may be associated with lateral (fibular) displacement of the digits, and with bony outgrowths at the margin of the affected articulations. The movements of the joints are much more impaired than in true hammer toe, owing to changes in the cartilage ; and fibrous ankylosis is often present. 3. Manifestations of the causative disease may be found in other parts of the body.

In the great toe the direction of the distortion appears to depend upon the size and position of the osteophytic developments at the margin of the affected articulation. Most commonly the position simulated is that of hallux valgus, more rarely that of hallux flexus, and we may also find a condition in which the distal phalanx is bent upwards, so

that the nail approaches or even touches the dorsal surface of the first phalanx. (See Fig. 16, A.) This is a painful deformity and calls for treatment. I have not yet seen an arthritic hallux varus. It is probably rare, because the form of the boot opposes the divergence of the toe in the inward direction.

It is unnecessary here to say anything as to the nature and course of the general disease. As

FIG. 16.



Rheumatoid arthritis. Retracted hallux with arthritic hammer toes.

A. Before operation; B. After operation. The dotted outline in A indicates the position of the flap made to expose the diseased joint. From casts at St. Thomas's Hospital.

a rule the case falls into the hands of the physician, and the surgeon is rarely asked to intervene. It must be pointed out, however, that the contractions may cause severe inconvenience, and that despite the intractable nature of the complaint the reaction of the patient to surgical operation is favourable, recovery being nearly as speedy as in true hammer toe. I have on two occasions operated with the result of considerable relief to suffering, and without any surgical casualty. In

one instance eight toes underwent operation at a single sitting, and the wounds all healed by immediate union.

In gouty contractions of the toes the history of the sudden and painful inflammatory attacks preceding the deformity, the almost constant implication of the first metatarso-phalangeal joint, and the presence of other indications of gout leave no question as to the nature of the disease. In this affection the surgeon can rarely be called upon to interfere. The distortions of the great toe are generally associated with eversion—a valgus—and complete ankylosis may supervene. Contractions in association with acute rheumatism or acute rheumatoid arthritis are comparatively rare. Lastly, certain arthritic affections of neuropathic origin may produce ankylosis of the joints, sometimes in association with rapid atrophy of the muscular and integumentary structures, as in a case shown by the author at the Medical Society in 1893 (*Trans.*, vol. xvii. p. 104).

PARALYTIC CONTRACTIONS OF THE TOES.

Deformities of this kind may be met with in association with various diseases of the nervous system. The most common condition is a hammer deformity of the lesser toes, with retraction at the metatarso-phalangeal joint, and an exaggeration of the plantar arch (paralytic cavus). This is

probably due to paralysis of the interossei in nearly all cases. Occasionally a single toe is affected. In the great toe it may arise from paralysis either of the short flexors or of the tibialis anticus (as pointed out by Mr. Davies-Colley), and is associated with retraction of the first phalanx and flexion of the second. In the smaller toes the digits assume a position like that of the clawed finger in ulnar paralysis, with extension of the proximal and flexion of the middle and distal phalanges, but, unlike in true hammer toe, there is distinct evidence of paralysis, and the capacity of the flexed joints for passive extension is usually retained for long periods. In these cases where the unopposed extensor leads to very inconvenient retraction of the first phalanx the tendon may be divided, and Mr. Davies-Colley suggests that the proximal cut end should be fixed to the metatarsal bone in order to preserve its utility as a dorsal flexor of the ankle. The return of the deformity must be prevented by the subsequent use of splints and manipulation.

SECTION III

CONGENITAL DEFORMITIES OF THE HANDS AND FEET

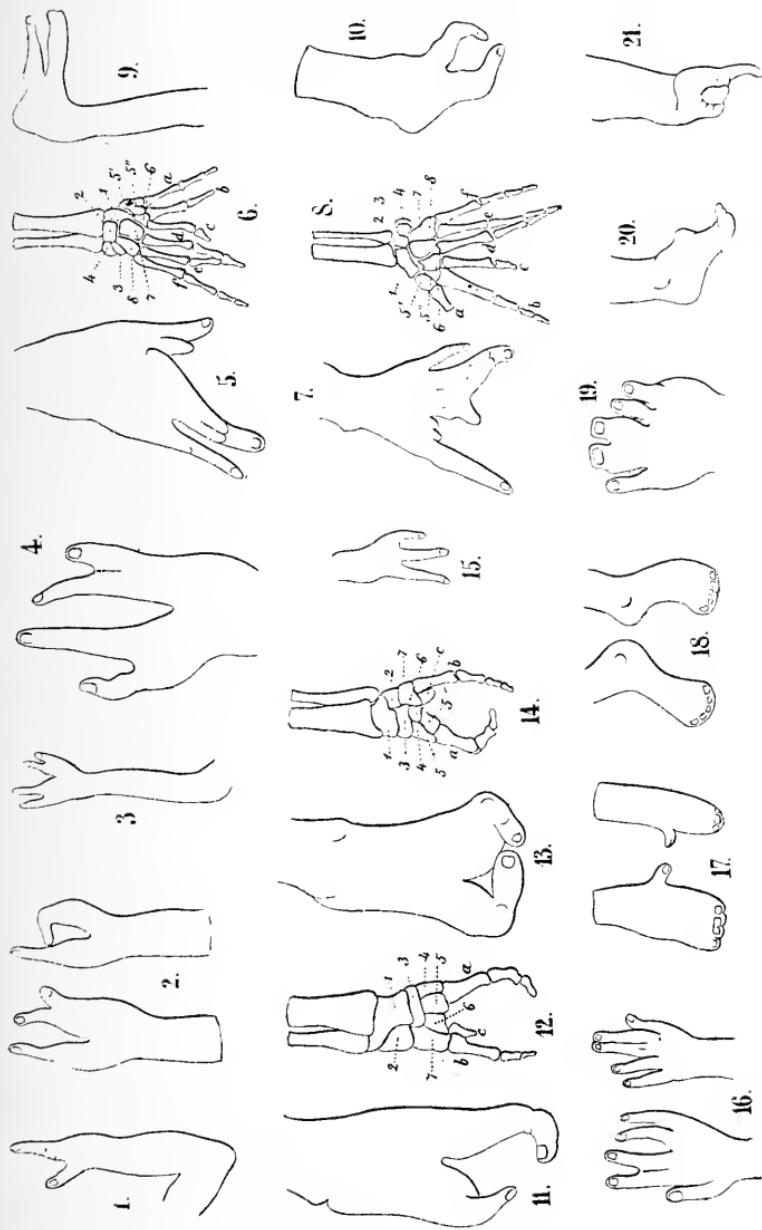
THE congenital deformities of the hands and feet are very numerous. They include excessive growth, a variety of other irregularities and deficiencies of nutrition, numerical increase of parts and abnormal union of digits. These defects are often hereditary, they may co-exist in various combinations, and may be associated with faults of evolution in other parts of the body. In most cases the *rôle* of the surgeon is limited to the removal of useless or unsightly parts, but occasionally a higher function is open to him.

The most interesting of the congenital defects of the digits is the curious and often complex condition known as makrodactyly.

MAKRODACTYLY.

The earliest examples of “congenital hypertrophy” recorded in this country were those of Dr. Reid, published in the *London and Edinburgh*

FIG. 17.

Various congenital defects of the hands and feet (from Fürster, *Missbildungen des Menschen*).

1 to 4 and 15.—Numerical defects of fingers.
5 to 14.—Hands and feet with combination of hypertrophy and defective development of fingers and toes, all from the same individual.
10 to 14 show the crab-like deformity described in the text (p. 147).
16, 17, 18, 19.—Syndactyly. In 16 and 19 the united fingers are

larger than their neighbours. In 17 and 18 the union involves all the fingers except the first, and on one hand the number of digits is reduced to four.

20, 21.—Hand and foot with suppression of first four digits. In 20 there is a rudiment of the index or middle finger.

Monthly Journal of Medical Science for March 1843, but before this date a characteristic case of makrodactyly had been carefully described by von Klein,¹ and other instances had been brought forward by Beck² and Wagner.³ Reid's paper was followed by a valuable article by Curling,⁴ and contributions by Ideeler,⁵ Adams,⁶ Devouges,⁷ Chassaignac,⁸ Annandale,⁹ and others, but the first attempt to classify the cases was that of Busch,¹⁰ in 1866. Since this time many additions have been made to the literature of the subject, the most important of which are those of Trelat and Monod,¹¹ Vogt,¹² von Fischer,¹³ Wittelshöfer,¹⁴ and Humphry.¹⁵

The condition may be defined as a gigantic growth, congenital in origin, of various segments

¹ *Journal der Chirurg. und Augenheilk.*, v. Graefe u. Walther, 1824.

² *Med. Annalen*, v. Puchelt, Chelius, u. Nägele, 1836.

³ Schmidt's *Jahrbücher*, 1842.

⁴ *Medico-Chirurgical Transactions*, vol. xxviii.

⁵ "Dissertation" (Berlin). Quoted by Busch.

⁶ *Lancet*, August 1858.

⁷ *Bulletin de la Soc. Anat.*, 1856.

⁸ *Bulletin de la Soc. de Chirurg.*, first series, vol. xviii.; *Gazette des Hôpitaux*. 1858.

⁹ "Malformations, Diseases, and Injuries of Fingers and Toes," 1865.

¹⁰ "Beiträge z. Kentniss der angeb. Hypert. der Extrem.", *Langenbeck's Arch.*, 1867.

¹¹ "De l'Hypertrophie Unilaterale," *Arch. Gén. de Médecine*, May and June 1869.

¹² *Deutsche Chirurgie*, Lief. 64.

¹³ "Der Riesenwuchs," *Deutsche Zeitschrift für Chirurgie*, 1880, Bd. 12.

¹⁴ *Archives für Klin. Chirurg.*, Bd. xxiv. 1879.

¹⁵ *Trans. Med. Chi. Society*, vol. lxxiv. 1891.

of the body exclusive of the viscera. It is generally unilateral, and limited to one extremity or portion of an extremity; it tends to implicate especially the bones and joints, and the adipose and vascular elements of the subcutaneous tissue. It does not, as a rule, impair to any important extent the functional capacity of the part.

The name "congenital hypertrophy" is open to criticism. There is little doubt that the abnormality always has its origin in foetal life, but it has seldom been noticed immediately after the delivery of a child; and, on the other hand, in one case recorded by Lannelongue,¹ a "*macrodactylie elephantiasique*" in a child is said to have followed an operation for the separation of two united fingers. It is, at any rate, certain that if the enlargement be always present at birth, it is seldom so disproportionate as to attract attention and never so great as to interfere with parturition. Hence the colossal proportions subsequently observed are the result of excessive growth in early infancy and childhood, and occasionally in adult life.

The hyperplasia, moreover, is rarely hypertrophic in the higher sense of the term, for, although in a few cases the increased growth has been associated with apparent increase of functional utility, in the great majority of instances it is relegated to a lower status by its unequal distribution amongst the different tissues of the parts involved, its

¹ *Bulletin de la Soc. de Chirurgie*, December 1880.

frequent association with other congenital deformities, and especially by the defective ratio of functional capacity to the amount of constructive material. In other words, the process is wasteful and unserviceable.

The origin of the affection is very obscure. It is not hereditary, although inheritance plays a notable part in many other congenital deformities, and it cannot be attributed to any known influences arising during intra-uterine life, but, as might be expected, the mother is often able to conjure up some reminiscence of the period of gestation which to her mind affords a perfectly satisfactory clue to the mystery. Von Klein relates that in his case of makrodactyly the mother while pregnant was bitten in the hand by a goose. A history of a fright was given in Adams's case, and in an instance reported by the author¹ a giant growth of the lower extremity was attributed to the mother having been trodden upon by a cow. Such mental impressions are probably mere coincidences, and are often greatly exaggerated in narration, but until the possibility of their connection with foetal lesions is disproved it is advisable to place them on record.

Parts affected. — The abnormality is usually limited to one side of the body. Comparatively few bilateral cases have been observed, and in

¹ *St. Thomas's Hospital Reports*, vol. xi. 1881, p. 165.

most of these the makroplasia was limited to the digits.¹

The nævi with which the hypertrophy is often associated are nearly always confined to the affected side, but in two cases of Chassaignac and Friedberg they were found also upon the non-hypertrophied side, and in a second case of Chassaignac's were present only upon the unenlarged parts of the body. The upper extremity is attacked nearly twice as often as the lower, and the right side much more frequently than the left. In bilateral cases the affection is seldom symmetrical; thus, on one of Friedberg's cases the predominant enlargement of the right lower extremity was associated with a small degree of hypertrophy of the left upper limb.

The extent of the parts involved ranges from a single digit to an entire half of the body. When a whole limb is implicated the growth is always proportionately greater at the distal extremity, but colossal development of the hand or foot seldom includes the whole of the digits. The localisation of the affection does not appear to be related to any special vascular or nervous territories; thus, in makrodactyly, the regions of distribution of the digital branches of both median and ulnar nerves may be encroached upon, while

¹ V. Fischer describes the case of Devouges as one in which parts on both sides were affected, but a reference to the original and to Chassaignac's report upon the same patient shows that the hypertrophy was unilateral.

parts supplied by either or both of these may escape intact.

Commonly, however, both in the hand and foot,

FIG. 18.



Congenital hypertrophy of lower extremity, with lymphangioma (from a case of the author's).

the hypertrophy selects two or three neighbouring digits, for example, the second and third; and co-existent lipomata are almost invariably limited to that portion of the palm or sole which corresponds to the enlarged fingers or toes. In the

hand the digit most commonly affected is the third, the fifth is that most exempt.

Its *course* is always in a certain sense progressive. Occasionally it appears to keep pace throughout with the general growth of the body, but nearly always the abnormal growth strides in advance, sooner or later, so that the disproportion of the affected part to the rest of the body becomes more and more pronounced. Its progress may be uniform and continuous, or terms of slow increase or apparent arrest may alternate with a new and rapid development.

In some instances the process does not extend beyond the primary limits, while in others it may spread centripetally, and often at a very rapid rate, as in v. Fischer's case (*l.c.*), in which amputation of an hypertrophied finger was followed within a few months by hypertrophy of the whole limb. In two cases reported by Mr. F. S. Eve¹ a growth became disproportionately active at the ages of twenty-three and thirty-seven respectively. Similar instances have been published by Wittelshöfer, and the author (*l.c.*).

The addition of new tissue goes on, as a rule, without pain, inflammation, or interference with function ; but in a case of von Fischer's, burning pain was associated with trophic ulceration ; and Friedberg's patient,² who appeared to be the

¹ *Trans. Path. Society*, 1883, p. 298.

² *Virchow's Archives*, 1867, vol. xl.

subject of an associated elephantiasis Arabum, had symptoms that somewhat resembled the inflammation crises of elephantiasis.

In the majority of cases the *functional power* of the enlarged part is not augmented, but true unilateral hypertrophy, *i.e.*, increased tissue hypertrophy with proportionally increased functional activity, is sometimes found. The cases described long since in general terms by Geoffroy St. Hilaire,¹ as marked by an unequal development of the two sides of the body in one or more regions, were probably of this nature, and those of Ollier, Finlayson, and Langlet, may also claim a place in the same class. In Ollier's case² the face, thorax, abdomen, and both extremities of one side, were uniformly larger than the corresponding parts of the opposite half of the body, the vascularity of the hypertrophied side was increased, the temperature elevated, and the limbs were more powerful. There were no nævoid growths, and it is noteworthy that in association with an absence of evident abnormality of thoracic, pelvic, and abdominal viscera, the mammary glands preserved their symmetry. The cases of Devouges, Adams, and Finlayson, also presented certain points of resemblance to true hypertrophy. In the first the whole of one side was hypertrophied, except

¹ "Histoire Général et Particulière des Anomalies de l'Organization chez l'Homme."

² *Gazette Médicale de Lyon*, July 1862 (Ollier); *Union Médicale et Scientifique du Nord est*, 1882 (Langlet).

perhaps the abdominal wall, where nothing unusual was noticed. The details are very imperfect, but according to the patient's statement, the strength of the arm on the hypertrophied side was greatly in excess of that of its fellow. In Adams's case the giant growth of the right lower extremity was apparently uniform, and the femoral and all other accessible arteries were considerably enlarged, but nothing is said as to muscular power. In this as in the last example naevi were present. In an unpublished case of the author's the hypertrophied hand was much stronger than its fellow; but in the example¹ already quoted there was no evidence of increased development of muscle. In two instances of unilateral hypertrophy of the face described by Friedrich² and Passauer,³ the increased growth involved the whole of the parts of the affected side, even to the teeth and tongue, and in Friedrich's patient, and in a case brought by Dr. Heumann before a Medical Congress in Darmstadt, the hair was more developed, and the secretion of saliva was excessive on the affected side, but the muscular power and arterial supply were not specially referred to. In a case of Eve's the facial hypertrophy extended to the brain.

In the ordinary forms of congenital hypertrophy

¹ *St. Thomas's Hospital Reports*, vol. xi. 1881.

² *Archives für Path. Anat.*, vol. xxviii. 1863.

³ *Virchow's Archives*, Bd. xxxvii. 1866.

the size of the part is augmented by an unequally distributed hyperplasia of the skeleton and soft parts. Almost all the cases narrated in detail are of this kind. In nearly all, the arterial supply is proportionate only to the normal size of the part, and the functional capacity (power, sensibility, &c.), although not seriously altered, is to some extent deteriorated. The cases may be for practical purposes divided into two groups :

1. Without deformity, the enlarged segment preserving the normal contour in other respects.
2. With deformity.
 - a. From predominant development of the adipose or vascular tissues.
 - b. From secondary articular distortions.
 - c. From associated defects of development, as syndactyly, &c.

The condition of the different elements of the enlarged part is as follows :

The *bones* are always enlarged. Their general shape is commonly preserved, but occasionally their extremities are deformed by outgrowths at the line of junction with the articular cartilage. The hypertrophy reaches its greatest proportionate extent in the digits, while increase in size of the bones of the forearm, arm, leg, and thigh, is, as a rule, only demonstrable during life by admeasurement of length. No histological abnormality has been detected in the osseous tissue, but Eve (*l.c.*)

found the cancellous tissue of the enlarged bone soft and the medulla fatty.

The *articular surfaces* may present no peculiar features, but in some cases the cartilages show irregularities of surface. The ligaments are usually greatly thickened. The synovial membrane commonly has the ordinary characters, varied only by an excessive development of the plicæ adiposæ.

The range of motion is sometimes normal; in other cases the voluntary movements are more or less diminished in extent, while a fair amount of passive mobility is preserved; and in others there is complete ankylosis.

Distortions, such as lateral deviation and hyper-extension, are frequent. The former appears to depend upon malformation of bone.

The *tendons* inserted into the enlarged bones have been found proportionately over-developed. The *muscles*, however, are seldom hypertrophied, and occasionally, as in Busch's case, they may undergo an atrophy secondary to the impaired mobility of the joint. In a case of von Fischer's, muscular hypertrophy was demonstrated, but no evidence of increased power was present; and, judging by the comparative disuse of the limb, it is probable that the strength was lessened. The muscular power is, as a rule, so far augmented in response to functional necessity that the enlarged part may be used without more sense of effort

than that which accompanies the same actions on the normal side, as in Wagner's case (*l.c.*), in which the hand weighed about twelve pounds and yet could be moved with perfect ease; there is seldom, however, any such absolute increase of strength as would indicate a genuine muscular hypertrophy.

The *arteries* in all the instances of false hypertrophy, with the exception of Reid's¹ cases, were of ordinary size and apparently not enlarged in proportion to the gigantic development of the part to be nourished. This is a fact of considerable pathological significance.

The *veins* and *capillaries*, unlike the arteries, appear especially liable to change. Varicosities of the veins are very common, and in some cases great thickening of the walls may be superadded (Busch, *l.c.*). In Dr. Finlayson's case the cutaneous vessels over the enlarged parts and in patches over the trunk became enlarged when the child cried, but subsided during quiescence.

In Wagner's case the fingers of the hypertrophied hand were said to become as red as a "Blutschwamm" when the member hung down, the arteries being nevertheless of normal size.

Angiectases and angioma are frequently seen. Capillary nævi of enormous extent sometimes co-exist (as in Adams's case, in which the whole

¹ It is somewhat curious that in all three of Dr. Reid's cases, which in most respects were of the ordinary type, the arteries are said to have presented the exceptional peculiarity of enlargement.

lower extremity and buttock were involved), and are usually, but not invariably, confined to the hypertrophied parts.

The *lymphatics* are liable to dilatation, and may form diffuse swellings or soft tumours of considerable extent. The glands, however, are never affected.

The *nerves* appear to be normal. The condition of the nerve centres has not yet been investigated except in a case of Eve's, in which the lateral asymmetry of the head and face extended to the brain.

The *integuments* nearly always participate in the changes, and are necessarily augmented in extent where covering the enlarged bones. The derm does not appear to be much altered in structure, but Eve found in the skin over the hypertrophied sole a thinning of the rete with almost complete obliteration of papillæ and enormous thickening of the fibrous tissues and inter-fascicular lymph spaces ; but these changes were probably due to the abnormal pressure and friction to which the part was exposed. The subcutaneous adipose layer commonly shows a diffuse thickening, and in addition may undergo a circumscribed hypertrophy in the form of large lipomatous pads, which are mostly found upon the flexor aspect of the member affected, and correspond in situation and extent to the bony enlargement (Fig. 18) ; but the papillary and epithelial

layers do not undergo any sensible changes, nor, as a rule, are the hairs or sebaceous follicles more developed than on the opposite side. The nails of hypertrophied digits generally undergo proportionate development. The secretion of perspiration is seldom altered in amount or character, but in a case of Wittelshöfer the patient complained of profuse sweating from the affected limb. The cutaneous sensibility is variously described as unaffected or diminished, never increased. A reduction of the sensibility to heat and pain was found to accompany the tactile defect in von Fischer's case, and it is probable, as he suggests, that careful examination would generally reveal an impairment of the faculties. Pain is rarely complained of. Burning pain was present in association with trophic ulceration in a case of von Fischer, and pains of a rheumatic character appeared in the author's case, but this symptom probably formed no part of the original disease.

The *temperature* of the part is generally normal. By exception, a rise of $2^{\circ}-2\frac{1}{2}^{\circ}$ Fahr., of $2^{\circ}-6^{\circ}$ Fahr. (Reid), $2^{\circ}-4^{\circ}$ Fahr. (Finlayson), and of $\frac{1}{2}^{\circ}-1^{\circ}$ Cent. (Trelat and Monod) has been recorded.

Pathological complications are rarely met with. Trophic ulceration appeared in a case of von Fischer's; and in Friedberg's case an eruption resembling pemphigus was noted, but probably was not directly connected with the congenital

hypertrophy. Inflammatory crises, corresponding to those of elephantiasis Arabum, have been seen in only one instance, and in this the condition appeared to be complicated by true elephantiasis.

Associated defects of development are frequent in connection with makrodactyly. They may consist of multiplication, dwarfing, absence, or fusion of parts. The most common defect is syndactyly. Secondary distortions of the spine are found, however, when the hypertrophy of a single limb is very great. The general health does not appear to be affected by the condition.

Pathology.—The older views as to the pathological origin of congenital hypertrophy leave us little advanced towards a solution. The condition has been attributed to a congenital lesion of the vaso-motor centres; to a primitive vice in the mesoblast; and to an inherent tendency of the affected tissues to appropriate an excess of nutriment; but these theories only lead to the same point—that for some reason which our pathology is still inadequate to explain, there is a weakening of the governing power that regulates the ratio between supply and demand in the tissues; or, to quote from Professor Humphry (*l.c.*), “The cases obviously consist in an excess, an abnormally excessive growth of a normal part of the body—an excess not depending upon any superabundance of nutritive supply, or any modification of nerve influence, but upon an excess, a

want of due restraint, of that developmental force by which the several organs and structures acquire and maintain their proper dimensions and relations to one another, and by which their relative growth at different periods of life and under different circumstances (as of the genital organs at puberty). The nature and essence and habitat or source of the force is a mystery, perhaps past finding out."

This sums up the whole question. It is probably the same kind of misgovernment of tissue that leads to certain other deformities occurring both before and after birth, and to the development of some forms of new growth. How it originates remains for the pathologists of the future to decide.

Treatment.—No means yet devised has any power of restraining the tendency for the excessive and irregular growth in this condition. The only resources of the surgeon are to correct associated deformities as far as possible, and to remove parts that are sufficiently inconvenient or disfiguring to warrant the use of the knife.

SUPERNUMERARY FINGERS AND TOES.

The occasional occurrence of supernumerary fingers and toes is well known. As a rule the extra digit is a mere pediculated appendage bearing a nail and a more or less perfect representative of the

ungual phalanx; in other cases, however, it is complete and well formed, and furnished with a metacarpal or metatarsal bone of its own, or sharing the proximal bone with a neighbouring finger or toe. In rare instances the digits may undergo still further numeral increase even to a complete duplication of the normal complement.

The condition is commonly bilateral, and may affect all four extremities. It is liable to association with syndactyly and other congenital deformities, and it is occasionally handed down by inheritance as a family peculiarity. Sir William Lawrence refers to a condition of the kind which was traced through four generations, and other examples are on record.

SYNDACTYLY.

The absence of one or more of the normal clefts between the fingers or toes is a common congenital deformity, and, like most of the other inherited defects of the parts, is often transmitted by descent, and associated with other malformations.

Syndactyly presents all varieties in extent and degree. Most frequently two neighbouring digits are joined together by a web of integument involving the whole or a portion of their length, but in some instances the connecting material is much thicker, and in the most extreme cases even the

bones and joints are fused, leaving nothing but a furrow to indicate the line of union. (Fig. 17, Nos. 16 to 19.)

Treatment is rarely necessary in the case of the foot, and in the hand is practicable only when the band of union is cutaneous or cellulocutaneous.

If the web is composed only of a thin double fold of integument it is sufficient to divide it, provided that a return of the condition is prevented from taking place through union of the raw surfaces at the root of the web. This was formerly effected in the slighter cases by a preliminary perforation of the base of the fold, and the insertion of a piece of gold wire until a cicatricial canal has been established—as in piercing the lobule for the suspension of an ear-ring—and the same end may be gained after the division by putting a small epidermic graft upon the angle. Zeller's flap method is, however, the best. A small triangular flap is cut from the dorsum of the hand with its base opposite the heads of the metacarpal bones, its apex at the level of the first interphalangeal joint. This being dissected up and reversed, the whole length of the web is divided. The apex of the flap is then brought forwards between the separated digits into the proximal end of the cleft, and fixed to the cut edge of the palmar integument.

When the membrane is very thick, and the

bones are drawn close together, a more complicated proceeding is required, and the ingenious method of Didot may be employed. A longitudinal incision is carried through the whole thickness of the integument along the middle of the dorsum of one of the two united fingers, a second along the middle of the palmar aspect of the other finger, and by dissection each digit is made to furnish a rectangular flap to cover in the raw surface of its neighbour. The division of the tissue left after raising the flaps must be made with great care, in order to avoid injury to the digital nerves.

ECTRODACTYLY.

Simple congenital ectrodactyly, like the loss of a larger segment of an extremity, may arise either by intra-uterine traumatism or defective development. Amputation by an amniotic band or a coil of umbilical cord probably explains the majority of the cases, as well as the congenital constrictions sometimes found in the limbs or digits of the newborn child, but the occasional appearance of fingers or toes at the end of a congenital stump can only be accounted for on the hypothesis of a temporary suspension of development in the proximal portion of the stump, and we may assume the possibility of a like origin for the absence of the most distal portions of a member. In some instances an ectrodactyly is complicated

with other developmental errors, and may be transmitted through several generations. Attention has been especially drawn to cases of this class in the last few years. Two were recorded in detail in 1886 by Dr. Fotherby¹ and the author,² and a third was added five years ago by Messrs. Parker and Robinson.³ In all of these the defect was traced through three or four generations, selecting in an apparently indiscriminate way a large portion of the members of the family, whilst leaving others exempt. In some individuals all four limbs were attacked, in others the upper or lower only, but usually with a more or less perfect bilateral symmetry. In most cases the ectrodactyly was associated with deformities of the remaining digits, such as syndactyly, hypertrophy, and joint distortions; and where, as frequently happened, the middle digits were imperfectly developed and the others hypertrophied and distorted, the member assumed the appearance of the pincers of a lobster. (Fig. 17, Nos. 11 to 14.)

In Dr. Fotherby's and Messrs. Parker and Robinson's cases the defects were traced through three generations, affecting sixteen out of thirty-seven descendants in the one and sixteen out of thirty-three in the other; in the author's case the

¹ *Brit. Med. Journ.*, May 22, 1886.

² *Brit. Med. Journ.*, June 12, 1886.

³ *Clin. Soc. Trans.*, vol. xx. p. 181.

history extended to four generations, attacking twenty-four out of thirty-six children, and the divergence from the normal state tended to increase with the later scions.

As a rule, little or no treatment is called for in this condition, because habit has given the member a good deal of functional utility that surgical interference might injure or destroy ; but sometimes, and more particularly in the feet, it is permissible to operate for the purpose of lessening the deformity, as in Messrs. Parker and Robinson's case, where a plastic operation was performed with much benefit to the patient.

BRACHYDACTYLY.

Undue shortness of the fingers or toes may occur either as a congenital or as an acquired defect. The congenital form, due to imperfect formation of any or all of the bony elements of a digit (including the metacarpal bone), is insusceptible of treatment except by amputation, should that step be justified by the inconvenience or deformity attached to the defective member.

Acquired brachydactyly may arise in several ways. Occasionally it is to be traced to an arrest of development either due to an injury during childhood or adolescence, or without apparent explanation, but more frequently it is a result of disease. In younger subjects the most common cause is the

destruction of bone in tuberculous disease, which may practically eliminate a phalanx, leaving the rest healthy. In older people it may be met with in cases of perforating ulcer, the proximal phalanx of the great toe and sometimes other bones undergoing a slow and painless disintegration, which is manifested chiefly by a progressive shortening of the digit with few or none of the more obvious signs of caries.

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